

BIOLOGICAL SCIENCES COMMUNICATION PROJECT

# communiqué

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Director

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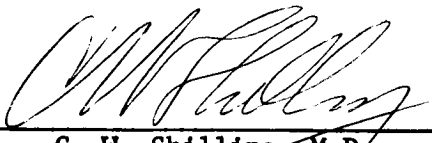
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## PLANETARY QUARANTINE

### Synopsis of Activities

The following describe the activities of the Planetary Quarantine portion of this contract for the reported quarterly period.

- 1) Planning procedures and scheduling of the sixth short course in "Environmental Microbiology for Engineers" have been determined. The course will be held at the Jet Propulsion Laboratory at Pasadena, California on October 30. Registration will be restricted entirely to JPL staff and facilities of the local high school will be utilized for laboratory instruction. This will be ~~the~~ third and final course offered during the contractual year. Preliminary plans for the seventh course have been initiated. It has been suggested that it be held in March 1968, however, the facilities to be used and location have not yet been determined.
- 2) A trip was made to the Audio-Visual facility, Communicable Disease Center, Atlanta, to finalize the technical services the BSCP is providing in conjunction with the filming of the movie "Planetary Quarantine". This production is now ready for viewing by NASA representatives.
- 3) A total of 600 reprints have been abstracted, catalogued into the termetrex system and microfilmed. The six microfilm magazines represent approximately 12,000 pages of printed material pertinent to the Planetary Quarantine Program of NASA. Duplicates of these film magazines have been provided to the libraries of the University of Missouri and the Sandia Corporation.
- 4) In support of a presentation on sterilization techniques at the London COSPAR meeting, by the Chief of Planetary Quarantine, a short bibliography of the most pertinent literature has been prepared. This bibliography is included herein under Tab #2. Three other bibliographies in the nature of more final reports are in preparation which will provide background information on Planetary Quarantine policies, microbiological techniques, and engineering parameters relative to spacecraft sterilization.
- 5) At the request of the Chief of Bioscience Communications, three weeks was spent at the Wallops station in participation of the Biospace Technology Training Program. A ninety minute presentation on NASA's policy on Planetary Quarantine and Spacecraft Sterilization programs was made. A small reference library of 100 volumes was also made available to the students for use during this course. A quantity of reprints and NASA publications were distributed to the students and requests for additional publications were referred to the Program Manager of the Bioscience Communications portion of this contract. A critique of the program has been prepared and sent to the appropriate program chief. A copy of the critique is enclosed under Tab #3.



- 6) More than 3,500 pages of reports, single page abstracts, photocopies from the microfilm file and copies of contractor reports were distributed to various NASA related bioscientists.
- 7) A staff scientist was added to the group in July and will expend part time effort on behalf of the Planetary Quarantine Program. The office was represented at the American Institute of Aeronautics and Astronautics meeting in Seattle in August. The topic of the program centered on the space mission of the 70's.

REFERENCE BIBLIOGRAPHY

1. COSPAR Information Bulletin No. 20. Fifth International Space Science Symposium (Florence). Secretariat, Paris, France, Nov. 1964. p. 25-26.
2. SAGAN, C. and COLEMAN, S. Spacecraft sterilization standards and contamination of Mars. Astro. and Aero. May, 1965. p. 22-27. 16 Refs.
3. CORNELL, R.G. Minutes of the Mathematical Models Subcommittee of the Spacecraft Sterilization Advisory Committee. Tallahassee, Fla., Feb. 8-9, 1967. 16 p.
4. CRAVEN, C.W., McDADE, J.J. and LIGHT, J.O. Sterilization and quarantine parameters for consideration during the design of planetary vehicles. In: Spacecraft Sterilization Technology. p. 43-50. Wash., D.C. NASA Pub. SP-108. Scientific and Technical Information Div. 1966.
5. CRAVEN, C.W. and WOLFSON, R. COSPAR Symposium on Sterilization Techniques for Instruments and Materials as Applied to Space Research. London, July 1967. (Unpublished).
6. HAYNES, N.R. Supporting document for planetary quarantine. JPL, Pasadena, Calif. Mar. 7, 1967. 23 p. 6 Refs.
7. NAT'L AERONAUT. & SPACE ADMIN. Standard procedures for the microbiological examination of space hardware. Wash., D.C., Office of Space Science and Applications, NASA Hdq. June 1, 1966. 40 p. 6 Refs.
8. U.S. GOVERNMENT. Clean room and work station requirements, controlled environment. Federal Standard No. 209a. Wash., D.C., GSA, Business Service Center. Aug. 10, 1966. 21 p.
9. AMER. ASSOC. FOR CONTAMINATION CONTROL. Fifth Annual Technical Mtg., Houston, Texas, Mar. 29-Apr. 1, 1966. Proceedings. 250 p.

10. SCHER, S., PACKER, E., and SAGAN, C. Biological contamination of Mars. 1: Survival of terrestrial microorganisms in simulated Martian environments. In: Florkin, M., Editor. Life Sciences and Space Research II. Amsterdam, North-Holland Pub. Co. 1964 p. 352-356
11. PACKER, E., SCHER, S. and SAGAN, C. Biological contamination of Mars. 2: Cold and aridity as constraints on the survival of terrestrial microorganisms in simulated Martian environments. Icarus 2: 293-316. 1963.
12. HAGEN, C.A. and HAWRYLEWICZ, E.J. Life in extraterrestrial environments. NASA (Contr. NASr-22). PR 16023-1 to L-6023-8. Chicago, Ill., Illinois Inst. Tech. Research Inst., 1965-67.
13. HOTCHIN, J., LORENZ, P. and HEMENWAY, C. Survival of microorganisms in space. Nature 206: 442-445, May 1965.
14. HALVORSON, H.O. and SRINIVASON, V.R. Can spores survive space travel? In: Sukalo, L.H., Editor. Proceedings of the Atmospheric Biology Conference, University of Minnesota. April 1964. p. 179-183.
15. ZHUKOVA, A.I., KOZLOVA, V. Kh. Resistance of certain strains of microorganisms to ultraviolet rays. Mikrobiologiya 35(2): 306-320. Feb. 1967.
16. ANGELOTTI, R., et al. Ecology and thermal inactivation of microbes in and on interplanetary space vehicle components. Research Project (R-36-015-001). 8th Quarterly Progress Report, Cincinnati, Ohio, Natl. Center for Urban and Industrial Health, U.S. Public Health Service, Apr. 1967. 13 p. 4 Refs.
17. DRUMMOND, D. and MAGISTRALE, V. Spacecraft sterilization technical programs. Tech. Report No. 32-853. Pasadena, Calif., Jet Propulsion Laboratory. Dec. 31, 1965.
18. REEDMANN, G.H. EASL/SADL test and operation. NASA Work Unit (189-58-23-04-55). Tech. Memo. 33-322, Vol. I. Pasadena, Calif., Jet Propulsion Laboratory. Jan. 31, 1967. p. 427-430.

- 199 SULLIVAN, L. and WEINBERG, C. Investigation of the reliability of sterile insertion techniques for spacecraft. Final Report (VOY-CR-66-9). Denver, Colo., Martin Co., Oct. 1966. 46 p. 3 Refs.
20. ZWERLING, S. Assembly/sterilizer facility program. Final Report 67SD604. Phila., Pa., General Electric Co. Feb. 21, 1967.
21. CRAWFORD, J.G. and ZANKS, J.F. The assembly/sterilizer - A facility for the sterilization and assembly of spacecraft. Amer. Inst. of Aero. and Astro./Amer. Astro. Soc., Baltimore, Md., Mar. 28-30, 1966. Proceedings. p. 346-350.

## BIOSCIENCE COMMUNICATIONS

### Analysis of Activities

During the past quarterly period, major efforts expended on the Bioscience Communication's portion of this contract concerned activities relating to the preparation of "Contractual Listings of Publications etc.", supported by various programs of the Bioscience Programs Division and the completion of author relationships pertaining to the development of a series of monographs entitled "Foundations of Space Biology and Medicine".

Reports on the contractual listings of publications resulting from the Bioscience Programs Division's support or partial support of research projects, have been completed for the following programs: Behavioral Biology, Environmental Biology, Exobiology, and Physical Biology. The Behavioral Biology report was completed during a previous quarterly period and was subsequently submitted to NASA. Material has been collected for the preparation of similar reports for Planetary Quarantine and Bioscience Communications. In these reports the publications were listed according to scientific organization, principal investigator, and contract/grant number to facilitate their use. While in themselves the citations of each reported activity provides an inaccurate means of assessing either effort or accomplishment, combined with other factors, they provide a useful measuring device in this regard. These reports were compiled to provide some assistance in the constructive appraisal of the Bioscience Programs Division's research activities in the respective scientific fields. Copies have been provided to the appropriate program chiefs. Reports completed during this quarterly period are contained herein under tabs 5 , 6 , 7 , for Environmental Biology, Exobiology, and Physical Biology, respectively.

Significant progress has been made in establishing author commitments for the preparation of the Monograph Series. All but five of the scientists approached have accepted author responsibilities for their assigned monographs. The proposed author for Monograph #5, "Search for and Investigation of Extraterrestrial Forms of Life", has declined authorship as has the proposed author for Monograph #17, "Air Regenerating and Conditioning and Integrated Characteristics of Life - Support System Complex". However, a substitute selection for the latter monograph is under consideration. The selected author of Monograph #11, "Psychophysiological Problems Connected with Flight and Stays in Spacecraft or Space Stations", and the selected author of Monograph #18, "Astronauts' Clothing and Personal Hygiene, Isolation and Removal of Waste Products, Habitability of Spacecraft, and Individual Life-Support Systems Outside a Spacecraft Cabin, Space Suits and Capsules", have not yet replied to an offer of authorship. The selected author of Monograph #19 will probably have to decline the offer of authorship because of contractual conflicts between his company and the NASA, and another author is currently being considered for this assignment. The accompanying Monograph Outline provides information concerning the status of the author relationships to the Monograph Series as of September 19, 1967.

Also in support of this activity and at the request of Dr. Bernard Newsom, the BSCP has provided the collaborators of monograph #19 with eighteen basic references pertaining to their interests and compiled a bibliography on Radiobiology containing 514 references taken from the bibliographic section of the Biospace Data Bank. In this report, only papers from 1959-1967 were included. An author index and a permuted title index with appropriate

descriptors added, were also included to permit rapid entry to the more specific items of interest to the reader. It was felt that this report would also be helpful to the compiler of Monograph #7 and, accordingly, copies were also sent to him. Dr. Newsom seemed sure that this work would be of considerable help in the preparation of his manuscript, and he has been assured that should he so desire the BSCP would make any reasonable attempt to obtain hard copies of any of the documents cited to assist him. This work is illustrative of the type of services the BSCP can render in support of this activity.

A format for the manuscript preparation of the monograph series has been established for the 1st to 6th order headings. "Radiobiology - A Selected Bibliography", is included here under tab 8. The monograph series outline indicating the development of author commitments and the format for headings are enclosed under tab 9.

The following paragraphs describe the other activities undertaken by the Biosciences Communication's portion of this contract during this quarter.

- 1) Bioscience Capsule #15 was issued during this period. It included a report on the Biosatellite Program, describing its activities, developments and the experiments flown on the Biosatellite II which has now been launched. Five unsolicited requests for the Capsule have been received during this period and the names have been added to the mailing list temporarily until the next calendar year when each requestor was asked to reassert his interest in receiving the Capsule. Bioscience Capsule #15 and the mailing list and related correspondence is enclosed under tab 10.
- 2) Queries for information concerning space biology have been few as is normal during this time of the year. A sizable request has been received from the secretary of the 1967 Biospace Technology Training Program at Wallops Island and other attendees. Their requested references are currently being assembled and should be made available shortly. As previously stated, we have also had a sizable request from a collaborator of the monograph entitled "Protection of Man Against Adverse Flight Factors". Appropriate references for a bibliography on Radiobiology were prepared and sent to him. A quick bibliography of approximately 200 references pertaining to space law was provided to the chief of Advanced Programs and Technology. Correspondence relating to these activities and related requests are included under Tab 11.
- 3) Through the use of the Depository's reports and publications resulting from the Bioscience Program's supported activities, the BSCP is compiling information necessary for the preparation of "Significant Achievements in Space Bioscience, 1967". This material is being appropriately indexed according to the subsummed subject interest of the report previously prepared.

- 4) Work continues to progress with the Space Bioscience Data Bank. More than 10,000 bibliographic items, most of them with abstracts provided, have been entered into the Termetrex system which includes a subject index of approximately 500 words. The Directories of space bioscientists and laboratories have been subjected to continuous maintenance and updating.
- 5) The NASA's requested investigation of the co-dependence and the value of basic and applied animal experimentation for providing biological indices for man has been undertaken. It is hoped that this study would intensify cross-disciplinary understanding and esteem among diverse segments of the scientific community engaged in different aspects of similar pursuits. Understanding of this type will greatly enhance the transfer of knowledge across disciplinary barriers by the resulting myriad of personal communications effected by a genuine appreciation of total science. To date, basic reference material is being assembled and a manuscript outline is being prepared. It should be noted that an outstanding authority on animal experimentation has consented to write this important document, Mr. Ralph Rohweder, former Executive Secretary of the National Society of Medical Research.
- 6) The BSCP is currently collating and subjecting to critical analysis evaluative data relating to the importance of the Bioscience Programs Division's activities and accomplishments and the need for continuation of its proposed endeavors. This in-depth study will provide a wealth of material essential for congressional budget defense presentations by this division.
- 7) During this contractual period, a need was established to provide the Advanced Programs and Technology Branch with system designed information processing procedures in order to maintain adequate surveillance of developing technology, programming, scheduling, and other factors related to the scientific and technological efforts of the Bioscience Programs Division. This highly specific information service will assuage the difficulties and problems concerned with the planning of in-flight bioscience experiments. Through the assistance of Tri-Delta Corporation, a system has been devised and will be presented to the associated NASA Headquarters personnel during the next quarterly period.

SEPTEMBER 1967

BIOLOGICAL SCIENCES COMMUNICATION REVIEW

# communiqué

CONTRACTUAL LISTINGS OF PUBLICATIONS

SUPPORTED BY THE ENVIRONMENTAL BIOLOGY PROGRAM,  
BIOSCIENCE PROGRAMS DIVISION

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION



CONTRACTUAL LISTINGS OF PUBLICATIONS  
SUPPORTED BY THE ENVIRONMENTAL BIOLOGY PROGRAM,  
BIOSCIENCE PROGRAMS DIVISION

of the

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

compiled by

L. A. Kulp, Frances Hong, and  
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BIOLOGICAL SCIENCES COMMUNICATION PROJECT

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SEPTEMBER 1967

C. W. Shilling, M. D.  
Director

## PREFACE

This report lists publications resulting from research supported, at least in part, by the Environmental Biology Branch of the National Aeronautics and Space Administration's Bioscience Programs Division. A few publications, however, may predate the establishment of this office but are included because they resulted from efforts which were subsequently subsumed under this program branch. Each project, indexed alphabetically according to the principal investigator, supported organization and contract or grant number, reveals the published activity of each contractual endeavor. The more than 300 citations contained herein were provided in answer to a letter requesting such information from the principal investigator of the various grants and contracts monitored by this office. Only those papers currently available are included; publications in press have been omitted.

Research programs involving large expenditures of both effort and funding must be subjected to periodic evaluation in order to identify the current state-of-the-art for the respective field and to reveal the direction that such organized activities are taking. By this means, areas of critical need are recognized and remedied, and areas of increasingly limited interest are given appropriate attention. There are various methods for evaluating such programs only one of which is by the quantity of publications ensuing from a given activity or group of related activities. While in itself it is an inaccurate means for appraising either effort or accomplishment, combined with other factors it provides a useful measuring device. Submission of this report is made to provide some assistance in the constructive appraisal of the National Aeronautics and Space Administration's research activities in the field of environmental biology.

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AND ADDRESS: U. S. Naval School of Aviation  
Medical Center  
Pensacola, Florida 32512

CONTRACT/GRANT NUMBER: R-10-009-(027)

CONTRACT/GRANT TITLE: Effects of Vibration on Chromosomes

1960

1. HIXSON, W. C., PALUDAN, C. T. and DOWNS, S. W. JR. Primate bioinstrumentation for two Jupiter ballistic flights. IRE Trans. Med. Electron. ME-7:318-325. Oct. 1960.

1962

2. BEISCHER, D. E. Survival of animals in magnetic fields of 120,000 gauss. U. S. Naval Med. Res. Inst., Bureau of Medicine and Surgery, Pensacola, Fla., MR005.13-9010 Subtask 1, Report No. 6. 1962. (NASA Order R-39)
3. BEISCHER, D. E. and MILLER, E. F. Exposure of man to low intensity magnetic fields. U. S. Naval Med. Res. Inst., Bureau of Medicine and Surgery, Pensacola, Fla., MR005.13-9010 Subtask 1, Report No. 5. 1962. (NASA Order R-39)
4. CLOSE, P., and BEISCHER, D. E. Experiments with Drosophila melanogaster in magnetic fields. U. S. Naval Med. Res. Inst., Bureau of Medicine and Surgery, Pensacola, Fla., MR005.13-9010 Subtask 1, Report No. 7. 1962. (NASA Order R-39)
5. MEEK, J. C., GRAYBIEL, A., BEISCHER, D. E. and RIOPELLE, A. J. Observations of canal sickness and adaptation in chimpanzees and squirrel monkeys in a slow rotation room. Aerosp. Med. 33:571-578. 1962.

1963

6. BEISCHER, D. E. Biological effects of magnetic fields in space travel. In 12th International Astronautical Congress, p. 515-525. New York, Academic Press, Inc., 1963.
7. BEISCHER, D. E. Biomagnetics. In Lectures in Aerospace Medicine, p. 365-386. Brooks AFB, Texas, Feb. 1963.

8. BEISCHER, D. E. Neurological responses to external electromagnetic energy. In A Critique of Currently Available Data and Hypotheses at the Brain Research Institute, UCLA. Co-Sponsored by the Brain Research Institute, UCLA and the Air Force Systems Command, USAF, p. 70-71. 1963.
9. FURRY, D. E., LOWERY, R. T., and BEISCHER, D. E. Laboratory maintenance of the squirrel monkey. Lab. Primate Newsletter 2:1-2. July 1963.

1964

10. BEISCHER, D. E. Biological effects of magnetic fields in their relation to space travel. In K. E. Schaefer, ed. Bio-astronautics, p. 173-180. New York, The MacMillan Co., 1964.
11. BEISCHER, D. E. Survival of animals in magnetic fields of 140,000 Oe. In M. F. Barnothy, ed. Biological Effects of Magnetic Fields, p. 201-208. New York, Plenum Press, 1964.
12. BEISCHER, D. E. and FURRY, D. E. Saimiri sciureus as an experimental animal. Ant. Rec. 148:615-624. 1964.
13. BEISCHER, D. E. and KNEPTON, J. C. JR. Influence of strong magnetic fields on the electrocardiogram of squirrel monkeys (Saimiri sciureus). Aerosp. Med. 35:939-944. 1964.
14. FURRY, D. E. Histopathologic evaluation of a laboratory primate: the squirrel monkey (Saimiri sciureus). U. S. Naval Med. Res. Inst., Bureau of Medicine and Surgery, Pensacola, Fla., MR005.13-9010 Subtask 5, Report No. 1. 1964. (NASA Order A-34681)
15. HIXSON, W. C. and BEISCHER, D. E. Biotelemetry of the triaxial ballistocardiogram and electrocardiogram in a weightless environment. Naval Aerosp. Med. Inst., Pensacola, Fla., Monograph 10, Sept. 8, 1964. (NASA Order No. R-20)

1965

16. BEISCHER, D. E. Biomagnetics. In Civilian and Military Uses of Aerospace. Ann. N. Y. Acad. Sci. 134:454-458. 1965.
17. BEISCHER, D. E. Experimental effects of very low and very high field strength. (Abstr.) Amer. Psychol. 20:564. 1965.

18. ESKIN, A., and RICCIO, D. C. Changes in spontaneous activity as a measure of sensitivity to rotation in the white rat. U. S. Naval Res. Inst., Bureau of Medicine and Surgery, Pensacola, Fla., MR005.13-6001 Subtask 1, Report No. 103. 1965. (NASA Order R-93)
19. ESKIN, A., and RICCIO, D. C. The effects of environmental temperature changes on the EKG of the squirrel monkey (Saimiri sciureus). U. S. Naval Med. Res. Inst., Bureau of Medicine and Surgery, Pensacola, Fla., MR005.13-9010 Subtask 5, Report No. 2. 1965. (NASA Order R-39)

1966

20. BEISCHER, D. E. Triaxial ballistocardiogram in a weightless environment. Proceedings of First World Congress on Ballistocardiography and Cardiovascular Dynamics, Amsterdam, Netherlands, 1965, p. 85-89. Basel/New York, Karger, 1966.
21. KNEPTON, J. C., JR. The influence of vibrations on chromosomes. *Aerosp. Med.* 37(6):608-612. 1966. 10 Refs.
22. RENO, V. R. Sea urchin mitosis in high magnetic fields. U. S. Naval Med. Res. Inst., Bureau of Medicine and Surgery, Pensacola, Fla., MR005.13-9010 Subtask 1, Report No. 9. 1966. (NASA Order R-39)
23. RENO, V. R., and BEISCHER, D. E. Cardiac excitability in high magnetic fields. *Aerosp. Med.* 37:1229-1232. Dec. 1966. 8 Refs.

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CONTRACT/GRANT NUMBER:

NASw-971

CONTRACT/GRANT TITLE:

Study of Chemosynthetic Gas Exchanger

1961

1. BONGERS, L. Radiation tolerances in photosynthesis and consequences of excess. In P. A. Campbell, ed. Medical and Biological Aspects of the Energies of Space, p. 299-322. New York, Columbia University Press. 1961.

1963

2. BONGERS, L. Question of sustaining man in space. In D. Carrick, ed. Research Reviews, p. 38. 1963/1964.

1964

3. BONGERS, L. Chemosynthetic gas exchanger. Baltimore, Md., Res. Inst. for Advanced Studies, Report ER 13270-4. July 1964.
4. BONGERS, L. Sustaining life in space - a new approach. Aerosp. Med. 35:139-144. 1964.
5. BONGERS, L., and KOK, B. Life support systems for space missions. Develop. Ind. Microbiol. 5:183-195. 1964.

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Baltimore, Maryland

CONTRACT/GRANT NUMBER: NsG-435

CONTRACT/GRANT TITLE: Relationship of Biochemical Activity  
to Environmental Adaptation and  
Developmental Changes in Ascaris.

1964

1. COSTELLO, L. C. and SMITH, W. The comparative biochemistry and development of Ascaris eggs. V. Changes in catalase activity during embryonation. Arch. Biochem. Biophys. 106:223-228. 1964.

1966

2. COSTELLO, L. C., SMITH, W., and FREDRICKS, W. The comparative biochemistry and development of Ascaris eggs. VI. Respiration and terminal oxidation during embryonation. Comp. Biochem. Physiol. 18:217-224. 1966.

1967

3. COSTELLO, L. C., SMITH, Q., and OYA, H. The comparative biochemistry and development of Ascaris eggs. VII. Malate oxidation and metabolism of unembryonated eggs. Comp. Biochem. Physiol. 21:161-170. 1967. 12 Refs.

PRINCIPAL INVESTIGATOR DE CICC0, DR. B. T.  
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CONTRACT/GRANT NUMBER: NGR-09-005-022

CONTRACT/GRANT TITLE: Genetic Studies of Hydrogen Bacteria  
and Their Application to Biological  
Life Support Systems

1966

1. ZIOBRO, M., and DeCICCO, B. T. A method for the determination of low frequency transformations with Hydrogenomonas facilis. Bacteriol. Proc., p.30. 1966.

PRINCIPAL INVESTIGATOR FOSTER, DR. J. F.  
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CONTRACT/GRANT NUMBER: NASr-100(03)  
CONTRACT/GRANT TITLE: Research on Techniques and Procedures  
for Cultivation of Hydrogen-Fixing  
Bacteria

1964

1. FOSTER, J. F., and LITCHFIELD, J. H. A continuous culture apparatus for the microbial utilization of hydrogen produced by electrolysis of water in closed-cycle space systems. Biotechnol. Bioeng. 6 (4):441-456. June 29, 1964.

1966

2. FOSTER, J. F. Carbon dioxide conversion for oxygen recovery. In K. Kammermeyer, ed. Atmosphere in Space Cabins and Closed Environments, p. 104-119. New York, Appleton-Century-Crofts, 1966.
3. FOSTER, J. F. Life support systems and outer space. Battelle Tech. Rev., p. 4-9. Jan. 1966.

1967

4. FOSTER, J. F., and LITCHFIELD, J. H. The effects of controlled environment on the growth of Hydrogenomonas bacteria in continuous cultures. In The Closed Life Support System, p. 201-212. Washington, D. C., Nat. Aeron. Space Admin., 1967. 6 Refs. (SP-134)

PRINCIPAL INVESTIGATOR GORDON, DR. S. A.  
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CONTRACT/GRANT NUMBER: R-46

CONTRACT/GRANT TITLE: Growth and Development of Plants in  
Compensated Gravitation, Magnetic,  
and Electrical Fields

1963

1. GORDON, S. A. Gravity and plant development: bases for experiment.  
In F. A. Gilfillan, ed. Space Biology. Proceedings of the  
24th Biology Colloquium, p. 75-105. Corvallis, Oregon, Oregon  
State University Press, 1963.

1965

2. DEDOLPH, R. R., BREEN, J. J., and GORDON, S. A. Geoelectric effect  
and geotropic curvature. Science 148(3673):1100-1101. 1965.
3. NAQVI, S. M., DEDOLPH, R. R., and GORDON, S. A. Auxin transport and  
geoelectric potential in corn coleoptile sections. Plant  
Physiol. 40(5):966-968. 1965.

1966

4. DEDOLPH, R. R., GORDON, S. A., and OEMICK, D. A. Geotropism in  
simulated low-gravity environments. Amer. J. Bot. 53(6):530-  
533. 1966.
5. DEDOLPH, R. R., NAQVI, S. M., and GORDON, S. A. Effect of gravity  
compensation on the geotropic sensitivity of Avena seedlings.  
Plant Physiol. 40(5):961-965. 1966.
6. DEDOLPH, R. R., NAQVI, S. M., and GORDON, S. A. Role of indole-3-  
acetic acid in modification of geotropic responses in clinostat  
rotated Avena seedlings. Plant Physiol. 41(5):897-902. 1966.
7. DEDOLPH, R. R., WILSON, B. R., BREEN, J. J., and CHORNEY, W. Simu-  
lated low-gravity environments and respiratory metabolism in  
Avena seedlings. Plant Physiol. 41(9):1520-1524. Nov. 1966.  
9 Refs.
8. GORDON, S. A., and SHEN-MILLER, J. On the thresholds of gravitational  
force perception by plants. In A. H. Brown and M. Florkin, eds.  
Life Sciences and Space Research, Vol. IV, p. 22-34. Washington,  
Spartan Books, 1966.



9. NAQVI, S. M., and GORDON, S. A. Auxin transport in Zea mays L. coleoptiles. I. Influence of gravity on the transport of indoleacetic acid-2-<sup>14</sup>C. Plant Physiol. 41(7):1113-1118. 1966.
10. SHEN-MILLER, J., and SHARP, W. R. An improved medium for rapid initiation of Arabidopsis tissue culture from seed. Bull. Torrey Bot. Club 93(1):68-69. Jan.-Feb. 1966.

PRINCIPAL INVESTIGATOR GROSCH, DR. D. S.  
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Genetics Department  
Raleigh, North Carolina

CONTRACT/GRANT NUMBER: NsG-678

CONTRACT/GRANT TITLE: The Utilization of Habrobracon and  
Artemia as Experimental Materials  
in Bioastronautic Studies.

1966

1. GROSCH, D. S. The combined effects of irradiation, vibration, and centrifugation on braconid fecundity, fertility, and life span. In Book of Abstracts, Third International Congress of Radiation Research, p. 99. Cortina D'Ampezzo, Italy. 1966.

PRINCIPAL INVESTIGATOR INGRAHAM, DR. J. L.  
AND ADDRESS: University of California  
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Davis, California 95616

CONTRACT/GRANT NUMBER: NsG-656

CONTRACT/GRANT TITLE: Theoretical Lower Limits of Temperature  
for Bacterial Growth

1965

1. PACKER, E. L., INGRAHAM, J. L., and SCHER, S. Factors affecting the rate of killings of Escherichia coli by repeated freezing and thawing. J. Bacteriol. 89(3):718-724. Mar. 1965.

PRINCIPAL INVESTIGATOR JORDAN, DR. J. P.  
AND ADDRESS: Oklahoma City University  
Department of Chemistry  
Oklahoma City, Oklahoma 73106

CONTRACT/GRANT NUMBER: NsG-300

CONTRACT/GRANT TITLE: Interdisciplinary Studies of the  
Effects of Space Environments on  
Biologic Systems

1963

1. CAHILL, C. L., JORDAN, J. P., ALLRED, J. B., and CLARK, R. T. Lipid and protein metabolism in rats in oxygen under simulated high altitude conditions. *Physiologist* 6:151. 1963.

1965

2. KOLLIAS, J., and JORDAN, J. P. An improved system for prolonged exposure of small animals to low pressure-artificial atmospheres. *J. Appl. Physiol.* 20:742. 1965.

1966

3. JORDAN, J. P., ALLRED, J. B., and BOND, A. D. Metabolic adaptation of rats to a high oxygen-low pressure environment. *Physiologist* 9:214. 1966.
4. JORDAN, J. P., ALLRED, J. B., CAHILL, C. L., and CLARK, R. T. The effect of discontinuous exposure of rats to a high oxygen-low pressure environment. *Aerosp. Med.* 37:368. 1966.

1967

5. BOND, A. D., JORDAN, J. P., and ALLRED, J. B. Metabolic changes in rats exposed to an oxygen-enriched environment. *Amer. J. Physiol.* 212:526-529. Feb. 1967. 23 Refs.

1966

10. JONES, L. W., and KOK, B. Photoinhibition of chloroplast reactions.  
I. Kinetics and action spectra. Plant Physiol. 41(6):1037-1043. June 1966. 27 Refs.
11. JONES, L. W., and KOK, B. Photoinhibition of chloroplast reactions.  
II. Multiple effects. Plant Physiol. 41(6):1044-1049. June 1966. 17 Refs.
12. KOK, B., and CHENIAE, G. M. Kinetics and intermediates of the oxygen evolution step in photosynthesis. In D. R. Sanadi, ed., Current Topics in Bioenergetics, Vol. 1. New York, Sterling Press, 1966.

PRINCIPAL INVESTIGATOR KOK, DR. B.  
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CONTRACT/GRANT NUMBER: NASw-747

CONTRACT/GRANT TITLE: Research in Photosynthesis

1963

1. BEINERT, H., and KOK, B. Relationship between light induced EPR signal and pigment P700. In Photosynthesis Mechanisms in Green Plants, p. 131-137. Washington, D. C., Nat. Acad. Sci. - Nat. Res. Counc., 1963. (Publ. 1145)
2. HOCH, G., and OWENS, O. V. H. Photoreactions and respiration. In Photosynthesis Mechanisms in Green Plants, p. 409-420. Washington, D. C., Nat. Acad. Sci. - Nat. Res. Counc., 1963. (Publ. 1145)
3. KOK, B. Fluorescence studies. In Photosynthesis Mechanisms in Green Plants, p. 45-55. Washington, D. C., Nat. Acad. Sci. - Nat. Res. Counc., 1963. (Publ. 1145)
4. KOK, B. Photosynthetic electron transport. In Photosynthesis Mechanisms in Green Plants, p. 35-44. Washington, D. C., Nat. Acad. Sci. - Nat. Res. Counc., 1963. (Publ. 1145)

1964

5. BEINERT, H., and KOK, B. An attempt at quantitation of the sharp light-induced electron paramagnetic resonance signal in photosynthetic materials. Biochim. Biophys. Acta 88:278-288. 1964.
6. HOCH, G. E. Two light reactions in photosynthesis. Rec. Chem. Progr. 25:165-180. 1964.

1965

7. KOK, B., and DATKO, E. A. Reducing power generated in the second photoact of photosynthesis. Plant Physiol. 40:1171-1177. 1965.
8. KOK, B., and RURAISKI, H. J. Plastocyanin photo-oxidation by detergent-treated chloroplasts. Biochim. Biophys. Acta 94:588-590. 1965.
9. KOK, B., RURAISKI, H. J., and OWENS, O. V. H. The reducing power generated in photoact I of photosynthesis. Biochim. Biophys. Acta 109:347-356. 1965.

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CONTRACT/GRANT NUMBER:    NSG 70-60

CONTRACT/GRANT TITLE:    Phycophysiology in Controlled Environments

1962

1. SOROKIN, C.    Carbon dioxide and bicarbonate in cell division.    Arch. Microbiol. 44:219-227.    1962.
2. SOROKIN, C.    Effects of acidity on cell division.    Exp. Cell Res. 27: 583-584.    1962.

1963

3. GALLOWAY, R. A., and KRAUSS, R. W.    Utilization of phosphorous sources by Chlorella.    In Japanese Society of Plant Physiologists, eds. Studies on Microalgae and Photosynthetic Bacteria, p. 569-576. Tokyo, University of Tokyo Press, 1963.
4. KRAUSS, R. W., and GALLOWAY, R. A.    Endogenous metabolism in algae. Ann. N. Y. Acad. Sci. 102:707-716.    1963.
5. SOROKIN, C.    The capacity for organic synthesis in cells of successive developmental stages.    Arch. Mikrobiol. 46:29-43.    1963.
6. SOROKIN, C.    Characteristics of the process of aging in algal cells. Science 140(3565):385.    (Abstr.)    Apr. 26, 1963.
7. SOROKIN, C.    Injury and recovery of photosynthesis in cells of successive developmental stages: temperature effects.    In Japanese Society of Plant Physiologists, eds. Studies on Microalgae and Photosynthetic Bacteria, p. 99-110.    Tokyo, University of Tokyo Press, 1963.
8. SOROKIN, C.    On the variability in the activity of the photosynthetic mechanisms.    In Photosynthetic Mechanisms in Green Plants, p. 742-750.    Nat. Acad. Sci. - Nat. Res. Council., 1963.

1964

9. KRAUSS, R. W.    Combined photosynthetic regenerative systems.    In Conference on Nutrition in Space and Related Waste Problems, p. 289-297.    1964.    (NASA SP-70)

10. SOROKIN, C. Aging at the cellular level. *Experientia* 20:353-362. 1964.
11. SOROKIN, C. Buffering activity of algal cells and its effect on cell division. *Exp. Cell Res.* 33:508-515. 1964.
12. SOROKIN, C. Organic synthesis in algal cells separated into age groups by fractional centrifugation. *Arch. Mikrobiol.* 49:193-208. 1964.
13. SOROKIN, C. Temperature tolerance: algae. In P. L. Altman and D. S. Ditmer, eds. *Biology Data Book*, Federation of American Societies for Experimental Biology, 1964.

1965

14. OSRETKAR, A., and KRAUSS, R. W. Growth and metabolism of Chlorella pyrenoidosa chick during substitution of Rb for K. *J. Phycol.* 1:23-34. 1965.
15. PATTERSON, G. W., and KRAUSS, R. W. Hydrocarbons and sterols from Chlorella. *Plant Physiol.* 40, Suppl. XVIII. 1965.
16. PATTERSON, G. W., and KRAUSS, R. W. Sterols of Chlorella. I. The naturally-occurring sterols of Chlorella vulgaris, C. ellipsoidea, and C. saccharophila. *Plant Cell Physiol.* 6(2):211-220. 1965.
17. SOROKIN, C. Carbon dioxide and cell division. *Nature* 206:35-37. 1965.
18. SOROKIN, C. Photosynthesis in cell development. *Biochim. Biophys. Acta* 94:42-52. 1965.
19. SOROKIN, C. Van Slyke's buffer values for cell secretions. *Protoplasma* 60:79-85. 1965.
20. SOROKIN, C., and KRAUSS, R. W. The dependence of cell division in Chlorella on temperature and light intensity. *Amer. J. Bot.* 52(1):331-339. 1965.

1966

21. KARLANDER, E. P., and KRAUSS, R. W. Responses of heterotrophic cultures of Chlorella vulgaris Beyerinck to darkness and light. I. Pigment and pH changes. *Plant Physiol.* 41(1):1-6. 1966.
22. KARLANDER, E. P., and KRAUSS, R. W. Responses of heterotrophic cultures of Chlorella vulgaris Beyerinck to darkness and light. II. Action spectrum for and mechanism of the light requirement for heterotrophic growth. *Plant Physiol.* 41(1):7-14. 1966.



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CONTRACT/GRANT NUMBER: NsG-231

CONTRACT/GRANT TITLE: Growth Patterns of Plants in the  
Absence of Gravity Effects

1963

1. LYON, C. J. Auxin transport in leaf epinasty. Plant Physiol. 38(5):  
567-574. Sept. 1963. 19 Refs.

1965

2. LYON, C. J. Action of gravity on basipetal transport of auxin.  
Plant Physiol. 40(5):953-961. Sept. 1965. 19 Refs.
3. LYON, C. J. Auxin transport in geotropic curvatures of a branched  
plant. Plant Physiol. 40(1):18-24. Jan. 1965. 14 Refs.

1966

4. LYON, C. J., and YOKOYAMA, K. Orientation of wheat seedling organs  
in relation to gravity. Plant Physiol. 41(6):1065-1073. June  
1966. 16 Refs.

PRINCIPAL INVESTIGATOR MACK, DR. P. B.  
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Nelda Childers Stark Laboratory for  
Human Nutrition Research  
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CONTRACT/GRANT NUMBER: NsG-440

CONTRACT/GRANT TITLE: Bone Mineral Metabolism in Bed  
Rest Patients

1965

1. VOGT, F. B., MACK, P. B., BEASLEY, W. G., SPENCER, W. A., CARDUS, D.,  
and VALBONNA, C. The effect of bed rest on bone mass and  
calcium balance. Bulletin of the Texas Institute of Rehabili-  
tation and Research. Apr. 1965.

1966

2. MACK, P. B. Radiographic bone densitometry. Conference under  
sponsorship of the National Aeronautics and Space Administration  
and the National Institutes of Health, Washington, D. C., Mar.  
25-27, 1965. 1966. (NASA SP-64)
3. VOGT, F. B., MACK, P. B., and JOHNSON, P. C. Tilt table response  
and blood volume changes associated with 30 days of recumbancy.  
Aerosp. Med. 37:771-777. August 1966. 13 Refs.

PRINCIPAL INVESTIGATOR MARR, DR. J. W.  
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CONTRACT/GRANT NUMBER: NsG-709

CONTRACT/GRANT TITLE: Life in Extreme Environments

1965

1. GATES, D. M. Energy exchange in the biosphere. First International Symposium on Ecosystems, Copenhagen, Proceedings by UNESCO. 1965.

1966

2. GATES, D. M., and DERBY, R. The temperature of tree trunks, calculated and observed. Amer. J. Bot. 53(6):580-587. 1966.
3. GATES, D. M., and JANKE, R. The energy environment of the alpine tundra. Oecol. Planta, Gauthier-Villars 1:39-62. 1966.
4. KREITH, F., and GATES, D. M. The micro-environment of broad leaf plants - convection, radiation, and transpiration. In Institute of Environmental Sciences 1966 Annual Technical Meeting Proceedings p. 209-213. Boulder, Colo., Univ. of Colorado, Institute of Arctic and Alpine Research, 1966. (Contrib. No. 26)
5. PARKHURST, D. F., and GATES, D. M. Transpiration resistance and energy budget of Populus sargentii leaves. Nature 210:172-174. 1966.

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CONTRACT/GRANT NUMBER: 48-001-004

CONTRACT/GRANT TITLE: Carbon Dioxide Metabolism of  
Hydrogenomonas

1967

1. MC FADDEN, B. A., KUEHN, G. D., and HOMANN, H. R.  $C^{14}O_2$  fixation, glutamate labeling, and the Krebs cycle in ribose-grown Hydrogenomonas facilis. J. Bacteriol. 93(3):879-885. March 1967. 28 Refs.
2. MC FADDEN, B. A., and TU, C. L. Regulation of autotrophic and heterotrophic  $CO_2$  fixation in Hydrogenomonas facilis. Ribulosediphosphate fixation. J. Bacteriol. 93(3):886-893. March 1967. 21 Refs.

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CONTRACT/GRANT NUMBER: NsG-210

CONTRACT/GRANT TITLE: Space and Planetary Ecology

1963

1. MONTGOMERY, P. O'B., NEUMEYER, B., and ROSENBLUM, E. Ultrastructural changes produced in bacteria by gravity. J. Cell Biol. 19(2): 51A. (Abstr.) Nov. 1963.
2. MONTGOMERY, P. O'B., REYNOLDS, R. C., and KARNEY, D. H. Sub-cellular effects of X-radiation. Lab. Invest. 12(8):858-859. Aug. 1963.
3. MONTGOMERY, P. O'B., REYNOLDS, R. C., KARNEY, D. H., and HUGHES, B. Nucleolar changes induced by ionizing radiations and carcinogenic agents. Fed. Proc. 22(2, Pt. 1):315. (Abstr.) Mar.-Apr. 1963.
4. MONTGOMERY, P. O'B., VAN ORDEN, F., and ROSENBLUM, E. A relationship between growth and gravity in bacteria. Aerosp. Med. 34(4):352-354. Apr. 1963.
5. REYNOLDS, R. C., MONTGOMERY, P. O'B., and KARNEY, D. H. Nucleolar "caps" - a morphologic entity produced by the carcinogen 4-nitroquinoline N-oxide. Cancer Res. 23(4):535-538. May 1963.

1964

6. MONTGOMERY, P. O'B., BONNER, W. A., and COOK, J. E. Flying and stepping spot television microscopy. J. Roy. Microscop. Soc. 83(1, 2):73-77. June 1964.
7. MONTGOMERY, P. O'B., and COOK, J. E. Biological and instrumentation designs for living human cell studies in orbiting satellites. Aerosp. Med. 35(3):276. Mar. 1964. (Abstr.)
8. MONTGOMERY, P. O'B., KARNEY, D. H., REYNOLDS, R. C., and McCLENDON, D. Cellular and sub-cellular effects of ionizing radiations. Amer. J. Pathol. 44(5):727-746. May 1964.
9. MONTGOMERY, P. O'B., MINTON, P. D., REYNOLDS, R. C., PRINCE, J., and CHAPMAN, C. L. The sensitivity of X-irradiated cells to ultraviolet radiation. Tex. Rep. Biol. Med. 22(3):556-565. Fall 1964.

10. MONTGOMERY, P. O'B., NEUMEYER, B., and ROSENBLUM, E. Ultra-structural alterations induced in E. coli by gravity. *Aerosp. Med.* 35(4):360-361. Apr. 1964.
11. MONTGOMERY, P. O'B., PRINCE, J., COOK, J. E., and REYNOLDS, R. C. Photo-protection and human malignant cells. *Tex. Rep. Biol. Med.* 22(1):152-155. Spring 1964.
12. MONTGOMERY, P. O'B., and REYNOLDS, R. C. Cellular and sub-cellular responses to ultraviolet radiation. *Lab. Invest.* 13(10):1234-1253. Oct. 1964.
13. MONTGOMERY, P. O'B., ROSENBLUM, E., and STAPP, B. Gravity, radiation and growth. *Aerosp. Med.* 35(8):731-733. Aug. 1964.
14. MONTGOMERY, P. O'B., STAPP, B., and ROSENBLUM, E. A comparison of the ultrastructural changes produced in bacteria by gravity and X-radiation. (Abstr.) *Fed. Proc.* 23(2, Pt. 1):441. Mar.-Apr. 1964.
15. REYNOLDS, R. C., and MONTGOMERY, P. O'B. Nucleolar alterations produced by Actinomycin D and 4-nitroquinoline N-oxide. *Proc. Amer. Ass. Cancer Res.* 5(1):53. (Abstr.) Mar. 1964.
16. REYNOLDS, R. C., MONTGOMERY, P. O'B., and HUGHES, B. Nucleolar "caps" produced by Actinomycin D. *Cancer Res.* 24(7):1269-1277. Aug. 1964.

1965

17. MONTGOMERY, P. O'B., COOK, J. E., and FRANTZ, R. The effects of prolonged centrifugation on Amoeba proteus. *Exp. Cell Res.* 40(1):140-142. Oct. 1965.
18. MONTGOMERY, P. O'B., COOK, J. E., and KARNEY, D. Ultraviolet microbeam irradiation of living cell membranes. *J. Cell Biol.* 26(3):959-961. Sept. 1965.
19. REYNOLDS, R. C., and MONTGOMERY, P. O'B. Nucleolar and cytoplasmic alterations produced by Actinomycin D and other metabolic inhibitors, an electron microscope and time-lapse study. (Abstr.) *Proc. Amer. Ass. Cancer Res.* 6:53. 1965.

1966

20. MONTGOMERY, P. O'B. Nucleolar studies. *Bull. Path.* 7(3):66-67. Mar. 1966.
21. MONTGOMERY, P. O'B., REYNOLDS, R. C., and COOK, J. E. Nucleolar "caps" induced by flying spot ultraviolet nuclear irradiation. *Amer. J. Pathol.* 49:555-567. Sept. 1966.

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MORRISON, DR. P. R.  
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CONTRACT/GRANT NUMBER: NsG-459

CONTRACT/GRANT TITLE: Experimental Studies on Physiological  
Adaptation to Environmental Extremes

1964

1. VIERECK, E. G., and MORRISON, P. Growth rate and the development of temperature regulation in the tundra vole, Microtus oeconomus. In Science in Alaska, p. 37-38. 1964.
2. WARMAN, N. E. A subminiature temperature transmitter for use with rodents. In Science in Alaska, p. 46-47. 1964.

1966

3. MORRISON, P. R. Temperature selection in Alaskan microtines. Proceedings of the Fourth International Biometeorologists Congress, Rutgers, Aug. 1966.

1967

4. MORRISON, P., and WARMAN, N. A thermal-gradient chamber for small animals, with digital output. Med. Biol. Eng. 5(1):41-45. Jan. 1967. 4 Refs.

PRINCIPAL INVESTIGATOR MOYER, DR. J. E.  
AND ADDRESS: U. S. Department of the Interior  
Federal Water Pollution Control  
Administration  
Ada, Oklahoma 74820

CONTRACT/GRANT NUMBER: R-99

CONTRACT/GRANT TITLE: Ecologic Relationships between  
Bacteria and Algae in Photosynthetic  
Gas Exchangers

1964

1. WARD, C. H., MOYER, J. E., and VELA, G. R. Studies on bacteria associated with Chlorella pyrenoidosa TX71105 in mass culture. Develop. Ind. Microbiol. 6:213-222. 1964. 12 Refs.

1966

2. VELA, G. R., and GUERRA, C. N. On the nature of mixed cultures of Chlorella pyrenoidosa TX71105 and various bacteria. J. Gen. Microbiol. 42:123-131. 1966. 18 Refs.



PRINCIPAL INVESTIGATOR    MUSACCHIA, DR. X. J.  
AND ADDRESS:                Space Sciences Research Center  
University of Missouri  
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Columbia, Missouri    65201

CONTRACT/GRANT NUMBER:    NsG-271-62

CONTRACT/GRANT TITLE:    Physiological Effects of Weight-  
   lessness and Space Radiations on  
   Hibernators

1963

1. MUSACCHIA, X. J., JELLINEK, M., and COOPER, T. Effects of X-irradiation during hibernation on tissue catecholamine contents. *Experientia* 19(8):418-419. 1963.
2. MUSACCHIA, X. J., and NEFF, S. S. Active absorption of D-glucose by intestinal segments of the ground-squirrel (Citellus tridecemlineatus). *Comp. Biochem. Physiol.* 9:37-40. 1963.

1964

3. MUSACCHIA, X. J., and FOX, A. M. Intestinal absorption and effects of radiation in the hibernator Citellus tridecemlineatus. *Fed. Proc.* 23(2, Pt. 1):972. 1964.
4. WESTHOFF, D. D., and MUSACCHIA, X. J. Intestinal absorption of sugar and effects of Co<sup>60</sup> irradiation in ground squirrel, Citellus tridecemlineatus. *Physiologist* 7(3):284. 1964.
5. WURTH, M. A., and MUSACCHIA, X. J. Renewal of intestinal epithelium in fresh water turtle, Chrysemys picta. *Anat. Rec.* 148:427-429. 1964.

1965

6. MUSACCHIA, X. J., GROSS, W. W., WURTH, M. A., and MUSACCHIA, B. C. Intestinal function and the role of hibernators in biosatellite experiments. *Proc. Mo. Acad. Sci.* 11:89-90. 1965.
7. MUSACCHIA, X. J., WESTHOFF, D. D., and BRAMANTE, A. V. Intestinal absorption of sugars in the hibernator, Citellus tridecemlineatus. *Fed. Proc.* 24(2):527. 1965.

1966

8. MUSACCHIA, X. J., and BRAMANTE, A. V. Intestinal absorption in hamsters and ground squirrels, in vivo. In K. C. Fisher, A. R. Dawe, C. P. Lyman, E. Schonbaum, and F. E. South, eds. Proceedings of the Third International Symposium on Natural Mammalian Hibernation, Toronto, Canada. Oliver and Boyd, Edinborough. 1966.
9. MUSACCHIA, X. J., WESTHOFF, D. D., and BRAMANTE, A. V. Effects of phlorizin on intestinal absorption in vivo and in vitro. Fed. Proc. 25(2):1. 1966.

PRINCIPAL INVESTIGATOR ODUM, DR. E. P.  
AND ADDRESS: Institute of Ecology  
Biological Sciences Building  
University of Georgia  
Athens, Georgia 30601

CONTRACT/GRANT NUMBER: NsG-706

CONTRACT/GRANT TITLE: Relationships between Size, Diversity,  
Stability of Semi-Enclosed Ecosystems

1965

1. BEYERS, R. J. The pattern of photosynthesis and respiration in laboratory microecosystems. Mem. Inst. Ital. Idrobiol. 18 (Suppl.):61-74. 1965.

1966

2. BEYERS, R. J. Metabolic similarities between symbiotic coelenterates and aquatic ecosystems. Arch. Hydrobiol. 62:273-284. 1966.

PRINCIPAL INVESTIGATOR PACE, DR. N.  
AND ADDRESS: University of California  
Department of Physiology-Anatomy  
Berkeley, California 94720

CONTRACT/GRANT NUMBER: NsG-513

CONTRACT/GRANT TITLE: Primate Hemodynamics and Metabolism  
in an Orbiting Satellite (PHAMOS)

1962

1. HANSEN, J. T., and PACE, N. Apparatus for automatic dye dilution measurement of cardiac output. J. Appl. Physiol. 17:163-166. 1962.

1963

2. HANSEN, J. T., and PACE, N. Evaluation of cardiovascular physiology in animals during space flight. Proc. San Diego Symp. Biomed. Eng. p. 209-213. 1963.
3. HANSEN, J. T., PACE, N., and RAHLMANN, D. F. Physiological monitoring of animals during space flight. Biomed. Sci. Instrum. 1:299-307. 1963.
4. PACE, N., HANSEN, J. T., and BARNSTEIN, N. J. Evaluation of circulatory function at null gravity. Advances in the Astronautical Sciences 10:210-219. 1963.

1964

5. PACE, N. The effects of weightlessness on mammals. In F. A. Gilfillan, ed. Space Biology, p. 65-74. Proceedings of the 24th Annual Biology Colloquium. Corvallis, Oregon State University Press, 1964.
6. PACE, N., HANSEN, J. T., RAHLMANN, D. F., BARNSTEIN, N. J., and CANNON, M. D. Preliminary observations of some physiological characteristics of the pig-tailed monkey, Macaca nemestrina. Aerosp. Med. 35:118-121. 1964.
7. RAHLMANN, D. F., HANSEN, J. T., PACE, N., BARNSTEIN, N. J., and Cannon, M. D. Handling procedures and equipment for physiological studies on the pig-tailed monkey (Macaca nemestrina). Lab. Anim. Care 14:125-130. 1964.

1965

8. GRUNBAUM, B. W. A self-contained and portable laboratory for microchemical analysis. *Microchem. J.* 9:371-383. 1965.
9. GRUNBAUM, B. W., and PACE, N. Microchemical urinalysis. I. Simplified determinations of ammonia, urea, creatinine, creatine, phosphate, uric acid, glucose, chloride, calcium and magnesium. *Microchem. J.* 9:166-183. 1965.
10. GRUNBAUM, B. W., and PACE, N. Microchemical urinalysis. II. Microturbidimetric determination of sulfate. *Microchem. J.* 9:184-186. 1965.
11. GRUNBAUM, B. W., PACE, N., and CANNON, M. D. Microchemical urinalysis. III. A simple automatic recording time-flow titrator. *Microchem. J.* 9:187-192. 1965.

1966

12. BARNSTEIN, N. J., GILFILLAN, R. S., PACE, N., and RAHLMAN, D. F. Chronic intravascular catheterization: a technique for implanting and maintaining arterial and venous catheters in laboratory primates. *J. Surg. Res.* 6:511-521. Dec. 1966. 15 Refs.
13. GRUNBAUM, B. W., and PACE, N. Improved procedure for individual urinary 17-ketosteroids. *Fed. Proc.* 25:766. 1966.

1967

14. RAHLMAN, D. F., PACE, N., and BARNSTEIN, N. J. Hematology of the pig-tailed monkey, Macaca nemestrina. *Folia Primatol.* 5(4): 280-284. 1967. 10 Refs.

PRINCIPAL INVESTIGATOR POPOVIC, DR. V. P.  
AND ADDRESS: Emory University  
Department of Physiology  
Atlanta, Georgia 30322

CONTRACT/GRANT NUMBER: NGR 11-001-(009)

CONTRACT/GRANT TITLE: Cardiovascular Adaptation during Long-Term Weightlessness

1965

1. KENT, K. M., and POPOVIC, V. P. Cardiovascular responses in hypothermia and hibernation. *Physiologist* 8:318. 1965.
2. PANUSKA, J. A., and POPOVIC, V. P. Critical temperature for instrumental response acquisition in hypothermic rats. *J. Appl. Physiol.* 20:1275-1277. 1965.
3. POPOVIC, P., and POPOVIC, V. P. Survival of young rats after supercooling to  $-3^{\circ}\text{C}$ . *Cryobiology* 2:23. 1965.
4. POPOVIC, P., SILVER, A. B., and POPOVIC, V. P. Critical body temperature for intracranial self-stimulation in white rats. *Physiologist* 8:320. 1965.
5. POPOVIC, V. P. Effect of hypothermia on growth and development of tumors. Abstract of the 23rd International Physiology Congress, p. 294. 1965.
6. POPOVIC, V. P., and KENT, K. M. Cardiovascular responses in prolonged hypothermia. *Amer. J. Physiol.* 209:1069-1074. 1965.
7. POPOVIC, V. P., and MASIRONI, R. Disappearance of euthermic tumors after 10-hour generalized hypothermia. *Life Sciences* 4:533-543. 1965.
8. POPOVIC, V. P., and MASIRONI, R. Disappearance of euthermic tumors ( $37^{\circ}\text{C}$ ) in shallow hypothermia. *Physiologist* 8:315. 1965.

1966

9. KENT, K. M., and POPOVIC, V. Circulation in hypothermic and hibernating animals. *Proceedings of the Fourth International Biometeorology Congress*, p. 21. Aug. 1966.

10. POPOVIC, P., HORECKY, J., and POPOVIC, V. P. Extracorporeal circulation in hypothermic rats. J. Physiol. 58:594. 1966.
11. POPOVIC, P., PANUSKA, J. A., and POPOVIC, V. P. Instrumental acquisition in rats after twelve exposures to deep hypothermia. Proc. Soc. Exp. Biol. Med. 122:337-341. 1966.
12. POPOVIC, V., and KENT, K. M. Factors limiting survival in hypothermic animals. Proceedings of the International Microcirculation Conference, Cambridge, p. 63-64. 1966.
13. POPOVIC, V., and MASIRONI, R. Disappearance of normothermic tumors in shallow (30°C) hypothermia. Cancer Res. 26:863-864. 1966.
14. POPOVIC, V. P., and MASIRONI, R. Effects of anti-cancer drugs on normothermic tumors of hypothermic hamsters. J. Physiol. 58:594-595. 1966.
15. POPOVIC, V., and MASIRONI, R. Effect of generalized hypothermia on normothermic tumors. Amer. J. Physiol. 211:462-466. 1966.
16. POPOVIC, V., and MASIRONI, R. Enhancement of 5-fluorocil action on normothermic tumors in generalized hypothermia. Cancer Res. 26:863-864. 1966.
17. POPOVIC, V., and MASIRONI, R. Generalized hypothermia enhances anti-cancer drug action on normothermic tumors. Physiologist Aug. 1966.
18. POPOVIC, V. P., and MASIRONI, R. Regression of normothermic tumors after generalized body cooling. (Abstr.) Ninth International Cancer Congress, P. 415. 1966.

PRINCIPAL INVESTIGATOR ROBINSON, DR. S.  
AND ADDRESS: Indiana University  
Department of Physiology  
Bloomington, Indiana 47401

CONTRACT/GRANT NUMBER: NsG-408

CONTRACT/GRANT TITLE: Anaerobic Work Capacity as Affected  
by Stress

1964

1. SCHNEIDER, E. G., ROBINSON, S., and NEWTON, J. L. The oxygen debt in aerobic work. Physiologist 7:247. 1964.

1965

2. NEWTON, J. L., and ROBINSON, S. Distribution of blood lactate and pyruvate during work and recovery. Fed. Proc. 24:590. 1965.

1966

3. GISOLFI, C., ROBINSON, S., and TURRELL, E. S. Effects of aerobic work performed during recovery from exhausting work. J. Appl. Physiol. 21:1767-1772. Nov. 1966.
4. KLAUSEN, K., ROBINSON, S., MICHAEL, E. D., and MYHRE, L. G. Effect of high altitude on maximal working capacity. J. Appl. Physiol. 21:1191-1194. 1966.



PRINCIPAL INVESTIGATOR SALISBURY, DR. F. B.  
AND ADDRESS: Plant Science Department  
Utah State University  
Logan, Utah 84321

CONTRACT/GRANT NUMBER: NsG-78-60

CONTRACT/GRANT TITLE: Research on Pathogen Free Plants in  
a Microcosm and on the Effects of  
High Intensity Light on Plant Growth

1962

1. SALISBURY, F. B. Martian biology. Science 136:17-26. 1962.

1964

2. MELLOR, R. S., RASCHKE, K., and SALISBURY, F. B. Leaf temperature in controlled environments. Planta (Berlin) 61:56-72. 1964.
3. SALISBURY, F. B. Exobiology. In G. J. D. Schock, ed. Proceedings of the First Annual Rocky Mountain Bioengineering Symposium, p. 75-83. Colorado Springs, Colo., United States Air Force Academy, 1964.
4. SALISBURY, F. B. Das Mars-Paradoxon. [Mars - Paradox]. Naturwiss. Med. 1(5):36-50. 1964.
5. SALISBURY, F. B. A special-purpose controlled-environment unit. Bot. Gaz. 125(4):237-241. 1964.
6. SALISBURY, F. B., and SPOMER, G. G. Leaf temperatures of alpine plants in the field. Planta (Berlin) 60:497-505. 1964.

1965

7. SALISBURY, F. B. The possibilities of life on Mars. In Proceedings of the Virginia Polytechnic Institute Conference on the Exploration of Mars and Venus, V. P. I., Blacksburg, Va., Aug. 23-27, 1965, p. VI-1 - VI-16. Blacksburg, Va., V. P. I., 1965. 17 Refs.

1966

8. CLINE, M. G., and SALISBURY, F. B. Effects of ultraviolet radiation on the leaves of higher plants. Radiat. Bot. 6:151-163. 1966.

PRINCIPAL INVESTIGATOR SIEGEL, DR. S. M.  
AND ADDRESS: Union Carbide  
P. O. Box 278  
Tarrytown, New York

CONTRACT/GRANT NUMBER: NASw-767

CONTRACT/GRANT TITLE: The Growth of Terrestrial Plants in  
Simulated and Modified Martian Envi-  
ronments

1964

1. SIEGEL, S. M., GIUMARRO, C., and LATTERELL, B. Behavior of plants under extraterrestrial conditions: seed germination in atmospheres containing nitrogen oxides. Proc. Nat. Acad. Sci. 52(1): 11-13. July 1964. 4 Refs.
2. SIEGEL, S. M., GIUMARRO, C., and RENWICK, G. M. Hydrogen metabolism in higher plants. Plant Physiol. 39(3):303-306. May 1964. 13 Refs.
3. SIEGEL, S. M., HALPERN, L. A., and GIUMARRO, C. Germination and seedling growth of winter rye in deuterium oxide. Nature 201 (4925):1244-1245. Mar. 21, 1964. 7 Refs.

1965

4. LATTERELL, R. L., and SIEGEL, S. M. Differential losses of seed viability conditioned by chemically inert gases. Amer. J. Bot. 52(6, Pt. 2):622-623. (Abstr.) July 1965.
5. SIEGEL, S. M. Effects of oxidants and ionizing conditions on seed germination at subatmospheric oxygen levels. Bot. Gaz. 125 (4):241-245. 1965. 7 Refs.
6. SIEGEL, S. M., and DALY, O. Responses of Cladonia rangiferina to environmental stress factors: temperature, radiation and water. Plant Physiol. 40(Suppl.):20. Aug. 1965.
7. SIEGEL, S. M., DALY, O. W., and DAVIS, G. General and comparative biology of experimental atmospheres and other stress conditions: experiments with the turtle, Pseudemys scripta-elegans. Aerosp. Med. 36(4):363-368. Apr. 1965. 8 Refs.
8. SIEGEL, S. M., DALY, O., and GIUMARRO, C. Experimentation with plants at sub-atmospheric oxygen-levels: effects of oxygen pressure and salts on germination of winter rye. Nature 208 (5014):1012-1013. Dec. 4, 1965. 6 Refs.
9. SIEGEL, S. M., and GIUMARRO, C. Survival and growth of terrestrial microorganisms in ammonia-rich atmospheres. Icarus 4(1):37-40. Feb. 1965. 9 Refs.

1966

10. LATTERELL, R. L. Nitrogen- and helium-induced anoxia: different lethal effects on rye seeds. *Science* 153(3731):69-70. July 1, 1966. 7 Refs.
11. SIEGEL, S. M., and DALY, O. W. The experimental biology of ammonia-rich environments. Germination of *Allium* seed, a novel capability among angiosperms. *Plant Physiol.* 41(7):1218-1221. 1966.
12. SIEGEL, S. M., and GIUMARRO, C. On the culture of a microorganism similar to the Precambrian microfossil *Kakabekia umbellata* Barghoorn in  $\text{NH}_3$ -rich atmospheres. *Proc. Nat. Acad. Sci.* 55 (2):349-353. Feb. 1966. 8 Refs.
13. SIEGEL, S. M., GIUMARRO, C., and DALY, O. W. Micro-aerobic capabilities in land plants: observations on survival and growth of plants submerged in fresh and saline waters. *Nature* 209 (5030):1330-1334. Mar. 26, 1966. 17 Refs.

PRINCIPAL INVESTIGATOR SMITH, DR. A. H.  
AND ADDRESS: University of California  
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Davis, California 95616

CONTRACT/GRANT NUMBER: NGR-05-004-008

CONTRACT/GRANT TITLE: Chronic Acceleration Studies - Physio-  
logic Responses to Artificial Altera-  
tions in Weight

1963

1. BURTON, R. R., RICHARDS, W. P. C., and SMITH, A. H. Pathology of chronic acceleration. *Aerosp. Med.* 34:249. 1963.
2. SMITH, A. H., and KELLY, C. F. Influence of chronic acceleration upon growth and body composition. *Ann. N. Y. Acad. Sci.* 110:410-424. 1963.

1965

3. BESCH, E. L., SMITH, A. H., and GOREN, S. Effect of accelerative forces on avian embryogenesis. *J. Appl. Physiol.* 20:1232-1240. 1965.
4. BESCH, E. L., SMITH, A. H., and WALKER, M. W. Morphological changes in avian eggs subjected to accelerative force. *J. Appl. Physiol.* 20:1241-1248. 1965.
5. BURTON, R. R., and SMITH, A. H. Chronic acceleration sickness. *Aerosp. Med.* 36:39-44. 1965.
6. SLUKA, S. J., BESCH, E. L., and SMITH, A. H. A hydrostatic pressure tester of egg shell strength. *Poultry Sci.* 44:1494-1500. 1965.
7. SMITH, A. H., and BURTON, R. R. Persistence of adaptation to chronic acceleration. *Physiologist* 8:273. 1965.
8. SMITH, A. H., and KELLY, C. F. Biological effects of chronic acceleration. *Naval Res. Rev.* 18:1-11. 1965.

1966

9. BESCH, E. L. Respiratory activity of avian blood cells. *J. Cell Comp. Physiol.* 67:301-306. 1966.

10. BESCH, E. L., and SLUKA, S. J. Blastoderm location in the avian egg. Poultry Sci. 45:259-262. 1966.
11. BURTON, R. R., BESCH, E. L., and SMITH, A. H. The erythrocyte sedimentation rate test in the domestic fowl. (Chicken). Poultry Sci. 45(6):1222-1230. Nov. 1966. 26 Refs.
12. KELLY, C. F., and SMITH, A. H. Chronic acceleration studies - physiological responses to artificial alteration in weight. Apr. 1966. (NASA Publ. CR-441, p. 8)
13. SLUKA, S. J., SMITH, A. H., and BESCH, E. L. Orientation in systems with asymmetric density distribution. Biophys. J. 6:175-199. 1966.

PRINCIPAL INVESTIGATOR SMITH, DR. R. E.  
AND ADDRESS: University of California  
Department of Physiology  
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Los Angeles, California 90024

CONTRACT/GRANT NUMBER: NsG-721

CONTRACT/GRANT TITLE: The Role of Brown Fat in the Thermo-  
genesis of Animals and Man

1965

1. HOCK, R. J., ROBERTS, J. C., and SMITH, R. E. Brown fat and thermoregulation in deer mice at altitude. *Physiologist* 8:195. 1965.
2. SMITH, R. E., and ROBERTS, J. C. Time dependent responses of brown fat in cold-exposed rats. *Physiologist* 8:275. 1965.

1966

3. CHAFFEE, R. R. J., HORVATH, S. M., SMITH, R. E., and WELSH, R. S. Studies on the cellular biochemistry and organ size of cold and heat acclimated monkeys. *Fed. Proc.* 25:1177-1181. 1966.
4. CHAFFEE, R. R. J., PENGELLEY, E. T., ALLEN, J. R., and SMITH, R. E. Biochemistry of brown fat and liver of hibernating golden-mantled ground squirrels (*Citellus lateralis*). *Can. J. Physiol. Pharmacol.* 44:217-223. 1966.
5. HOCK, R. J., and ROBERTS, J. C. Effect of altitude on oxygen consumption of deer mice: relation of temperature and season. *Can. J. Zool.* 44:365-376. 1966.
6. ROBERTS, J. C., HOCK, R. J., and SMITH, R. E. Seasonal metabolic responses of deer mice (*Peromyscus*) to temperature and altitude. *Fed. Proc.* 25:1275-1285. 1966.
7. SMITH, R. E., ROBERTS, J. C., and HITTELMAN, K. J. Non-phosphorylating respiration of mitochondria from brown adipose tissue of rats. *Science* 154:653-654. Nov. 4, 1966. 14 Refs.

1967

8. ROBERTS, J. C., and SMITH, R. E. Time dependent responses of brown fat in cold-exposed rats. *Amer. J. Physiol.* 212:519-525. Feb. 1967.

PRINCIPAL INVESTIGATOR SOUTH, DR. F. E.  
AND ADDRESS: University of Missouri  
Space Sciences Research Center  
Columbia, Missouri 65201

CONTRACT/GRANT NUMBER: NGR-06-002-(015)

CONTRACT/GRANT TITLE: Studies on Adaptation to Prolonged,  
Deep Hypothermia by Rats and its  
Relation to Hibernation

1966

1. GUMMA, M. R., SOUTH, F. E., and ANDJUS, R. K. Acclimatization to deep hypothermia by rats. Proc. Mo. Acad. Sci. Apr. 1966.
2. SOUTH, F. E., ANDJUS, R. K., and GUMMA, M. R. Acclimatization to deep hypothermia by rats. Fed. Proc. 25:2. 1966.
3. SOUTH, F. E., and HOUSE, W. A. Energy metabolism in hibernation. In K. C. Fisher, A. R. Dawe, C. P. Lyman, E. Schonbaum, and F. E. South, eds. Proceedings of the Third International Symposium on Natural Mammalian Hibernation, Toronto, Canada. Oliver and Boyd, Edinborough, 1966.

PRINCIPAL INVESTIGATOR SWAN, DR. H.  
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Sciences  
67 West Lakeridge Road  
Denver, Colorado 80227

CONTRACT/GRANT NUMBER: NASr-221

CONTRACT/GRANT TITLE: Anti-Metabolic Agent in Lung Fish

1966

1. SWAN, H., and HALL, F. G. Oxygen-hemoglobin dissociation in  
Protopterus aethiopicus. Amer. J. Physiol. 210(3):487-489.  
Mar. 1966. 4 Refs.



PRINCIPAL INVESTIGATOR SWEENEY, DR. K.  
AND ADDRESS: Space-General Corporation  
El Monte, California

CONTRACT/GRANT NUMBER: NASw-1037

CONTRACT/GRANT TITLE: Studies of Photosynthetic Halophiles  
from Owens Lake

1966

1. SWEENEY, K. Photosynthetic halophiles from Owens Lake. Washington,  
D. C., Nat. Aeron. and Space Admin., Jan. 1966, 71 p. Refs.  
(STAR N66-14905)

PRINCIPAL INVESTIGATOR THORNTON, DR. P. A.  
AND ADDRESS: Veterans Administration Hospital  
Lexington, Kentucky 40507

CONTRACT/GRANT NUMBER: NsG-675

CONTRACT/GRANT TITLE: Immobilization and Skeletal Atrophy

1965

1. THORNTON, P. A. The effect of immobilization on skeletal metabolism in guinea pigs with varying bone thickness. Physiologist 8:288. 1965.
2. THORNTON, P. A. Skeletal changes with age. Gerontologist 5:18. 1965.

1966

3. THORNTON, P. A., and OMDAHL, J. L. The influence of age on skeletal response to immobilization and ascorbic acid deficiency. In 7th International Congress of Gerontology, June 26-July 2, p. 15-23. 1966.

PRINCIPAL INVESTIGATOR TISCHER, DR. R. G.  
AND ADDRESS: Mississippi State University  
Department of Microbiology  
State College, Mississippi

CONTRACT/GRANT NUMBER: NsG-650

CONTRACT/GRANT TITLE: Influence of Metabolic Accumulation  
of Products of Hydrogenomonas Cells  
and Their Continued Growth

1962

1. CODY, R. M., and TISCHER, R. G. Microbial synthesis of animal feeds from human waste substrates. Develop. Ind. Microbiol. 3:53-62. 1962.

1963

2. CODY, R. M., and TISCHER, R. G. Quantitative measurement of urinary nitrogen and total solids depletion in a closed ecological system during microbial synthesis. Develop. Ind. Microbiol. 4:261-267. 1963.

1964

3. BROWN, L. R., COOK, D. W., and TISCHER, R. G. Preliminary studies on the extracellular products of Hydrogenomonas eutropha. Develop. Ind. Microbiol. 6:223-228. 1964.
4. CODY, R. M., and TISCHER, R. G. Oxidative metabolism of citrate and lactate by Pseudomonas aeruginosa and Serratia indica. Develop. Ind. Microbiol. 5:312-315. 1964.
5. MOORE, B. G., and TISCHER, R. G. Biosynthesis of extracellular polysaccharides by the blue-green alga Anabaena flosaquae. Can. J. Microbiol. 11:877-885. 1964.
6. MOORE, B. G., and TISCHER, R. G. Extracellular polysaccharides of algae: effects on life-support systems. Science 145(3632): 586-587. 1964.
7. MOORE, B. G., and TISCHER, R. G. Palmellocooccus species as a carbon-energy source for the growth of Torula utilis. Develop. Ind. Microbiol. 5:316-325. 1964.
8. TISCHER, R. G., and MOORE, B. G. An extracellular polysaccharide produced by Palmella mucosa Kutz. Arch. Mikrobiol. 49:158-166. 1964.

1965

9. TISCHER, R. G. Pure culture of Anabaena flos-aquae A-37. Nature 205:419-420. 1965.

1966

10. DAVIS, E. B., TISCHER, R. G., and BROWN, L. R. Nitrogen fixation by the blue-green alga Anabaena flos-aquae A-37. Physiol. Plant. 19:823-826. 1966.

PRINCIPAL INVESTIGATOR TOBIAS, DR. C. A.  
AND ADDRESS: Donner Laboratory and Donner Pavilion  
University of California  
Berkeley, California

CONTRACT/GRANT NUMBER: R-41

CONTRACT/GRANT TITLE: Biological Research with Heavy  
Ionizing Particles

1961

1. MAQSOOD, M., and ASHIKAWA, J. K. Fertility studies of X-irradiated male mice. Fertil. Steril. 12:452-458. 1961.
2. TOBIAS, C. A., and WALLACE, R. Particulate radiation: electrons and protons. In Medical and Biological Aspects of the Energies of Space, p. 421-442. New York, Columbia University Press. 1961.

1962

3. GAINNEY, M. D., BERGER, W. C., and TAGAMI, Y. A recording system for measuring bioelectric transients. Berkeley, Calif., University of California, Donner Lab. and Donner Pavilion, UCRL 10452. Sept 4, 1962.
4. JENKINS, T., and WALLACE, R. Argon-helium scintillation. Berkeley, California, University of California, Donner Lab. and Donner Pavilion, UCRL 10523. Oct. 24, 1962.
5. MAQSOOD, M., and ASHIKAWA, J. K. Post-irradiation protection and recovery. I. Effects of lipids on haematopoietic organs of X-irradiated male mice. Int. J. Radiat. Biol. 4:521-531. 1962.
6. MOYER, B. J., and WALLACE, R. Shielding and activation considerations for a meson factory. Berkeley, California, University of California, Donner Lab. and Donner Pavilion, UCRL 10086. Apr. 11, 1962.
7. TOBIAS, C. A., and SLATER, J. V. Our view of space biology widens. Astronautics 7:20-22, 47-52. 1962.
8. TODD, P. W. Proton activation in space vehicles. Berkeley, California, University of California, Donner Lab. and Donner Pavilion, UCRL 10683, p. 1-14. Fall 1962.
9. WALLACE, R. The physics of space radiation. Adv. Biol. Med. Phys. 8:343. 1962.

10. WALLACE, R., and SONDHAUS, C. Techniques used in shielding calculations for high-energy accelerators: applications to space shielding. Berkeley, California, University of California, Donner Lab. and Donner Pavilion, UCRL 10439. Oct. 11, 1962.

1963

11. ACETO, H. JR., and CHURCHILL, B. W. Neutron depth dose from ( $\alpha$ , h) and ( $\gamma$ , h) sources in a tissue-equivalent. Berkeley, California, University of California, Donner Lab. and Donner Pavilion, UCRL 10267. Mar. 4, 1963.
12. ADAMS, L. R., and SONDHAUS, C. A. A cytophotometric method for study of the erythroid development sequence in mammals. Berkeley, California, University of California, Donner Lab. and Donner Pavilion, UCRL 11033, p.118-125. Sept. 1963.
13. AMER, N. M. Modification of radiation effects with magnetic fields. Radiat. Res. 19:215. 1963. (Abstr.)
14. ASHIKAWA, J. K., SONDHAUS, C. A., TOBIAS, C. A., GREENFIELD, C., and HOWARD, J. Studies on the mammalian radiation syndrome with high-energy particulate radiation. I. Difference in injury mode and its dose-rate dependence for 100-kVp X-rays and 730-MeV protons. Berkeley, California, University of California, Donner Laboratory and Donner Pavilion, UCRL 11033, p. 12-18. Sept. 1963.
15. MANNEY, T. R., BRUSTAD, T., and TOBIAS, C. A. Effects of glycerol and of anoxia on the radio-sensitivity of haploid yeast cells to densely ionizing particles. Radiat. Res. 18:374. 1963.
16. POLISSAR, M. J. Convection in low gravitational fields. Berkeley, California, University of California, Donner Laboratory and Donner Pavilion, UCRL 11033, p. 83-98. 1963.
17. RESCIGNO, A. Multicompartment interpretation of radiation - damage curves. Berkeley, California, University of California, Donner Laboratory and Donner Pavilion, UCRL 11033, p. 59-64. Sept. 1963.
18. RESCIGNO, A. Operational calculus in two variables. Berkeley, California, University of California, Donner Laboratory and Donner Pavilion, UCRL 11033, p. 65-68. Sept. 1963.
19. SLATER, J. V., RESCIGNO, A., AMER, N. M., and TOBIAS, C. A. Temperature dependence of wing abnormality in Tribolium confusum. Science 140:408. 1963.

20. SLATER, J. V., TOBIAS, C. A., and AMER, N. M. Modification of radiation response during embryonic development by the use of elevated temperatures. 2nd International Congress of Radiation Research, Harrogate, England, 1962. In Radiation Effects in Physics, Chemistry and Biology. Amsterdam, North Holland, 1963.
21. SONDHAAUS, C. A., ASHIKAWA, J. K., TOBIAS, C. A., PASCHKES, V., and LOVE, D. Studies on the mammalian radiation syndrome with high-energy particulate radiation. II. Some factors affecting RBE of 730-MeV protons. Berkeley, California, University of California, Donner Laboratory and Donner Pavilion, UCRL 11184, p. 128-135. Fall 1963.
22. SONDHAAUS, C. A., STEWARD, P. G., and WALLACE, R. W. Depth dose in large phantoms irradiated omnidirectionally with high-energy protons. Berkeley, California, University of California, Donner Laboratory and Donner Pavilion, UCRL 11033, p. 19-28. Sept. 1963.
23. WALLACE, R., KASE, K., and SONDHAAUS, C. A. Characteristics and intensity profile of a high-energy-proton beam after scattering in a thick target. Berkeley, California, University of California, Donner Laboratory and Donner Pavilion, UCRL 11184, p. 136-140. Fall 1963.

1964

24. ASHIKAWA, J. K., SONDHAAUS, C. A., TOBIAS, C. A., GREENFIELD, A. G., and PASCHKES, V. Difference in injury mode, dose-rate dependence and RBE of 730-MeV protons, 100 kVp X-rays and 250 kVp X-rays. In Biological Effects of Neutron and Proton Irradiations, Vol. 1, p. 249-260. Vienna, International Atomic Energy Agency, 1964.
25. D'ANGIO, G. J., LAWRENCE, J. H., GOTTSCHALK, A., and LYMAN, J. Relative efficiency of high-LET radiation (Bragg-Peak lithium ions) on normal rabbit skin, using integral dose as a basis for comparison. Nature 204:1267-1268. 1964.
26. GAFFEY, C. T. Bioelectric sensitivity to irradiation of the retina and visual pathways. In T. J. Haley and R. S. Snider, eds. Response of the Nervous System to Ionizing Radiation, p. 243-270. Boston, Little, Brown, 1964.
27. GAFFEY, C. T. Blockage of pupillodilation with cyclotron-accelerated alpha particles. Berkeley, California, University of California, Donner Laboratory and Donner Pavilion, UCRL 11833, p. 121-133. Fall 1964.

28. MORTIMER, R. K., BRUSTAD, T., and CORMACK, D. V. Effectiveness of ionizing radiations for induction of mutations and lethality in diploid Saccharomyces cerevisiae, in relation to ionization density and oxygen tension. Berkeley, California, University of California, Donner Laboratory and Donner Pavilion, UCRL 11387, p. 35-53. Sept. 1964.
29. SLATER, J. V., LYMAN, J. T., TOBIAS, C. A., AMER, N. M., BECK, J. S., BECK, M., and SLATER, A. J. Heavy ion localization of sensitive embryonic sites in Tribolium. Radiat. Res. 21:541-549. 1964.
30. SONDHaus, C. A., WALLACE, R. W., LYMAN, J. T., KASE, K. W., and STEWARD, P. G. Physical parameters in exposure of large animals to high-energy protons. In Biological Effects of Neutron and Proton Irradiations, Vol. 1, p. 231-247. Vienna, International Atomic Energy Agency, 1964.
31. TOBIAS, C. A., LAWRENCE, J. H., LYMAN, J., BORN, J. L., GOTTSCHALK, A., LINFOOT, J., and McDONALD, L. Progress report on pituitary irradiation. In T. J. Haley and R. S. Snider, eds. Response of the Nervous System to Ionizing Radiation, p. 19-35. Boston, Little, Brown, 1964.
32. TOBIAS, C. A., and TODD, P. W. Analysis of the effects of high-LET radiations on various biological test objects. Berkeley, California, University of California, Donner Laboratory and Donner Pavilion, UCRL 11387, p. 25-34. Sept. 1964.
33. TOBIAS, C. A., and TODD, P. Analysis of the effects of high-LET radiation on various strains of cells. In Biological Effects of Neutron and Proton Irradiations, Vol. 2, p. 410-428. Vienna, International Atomic Energy Agency, 1964.
34. TYM, R., and TODD, P. W. The sensitization by iododeoxyuridine of cultured human cells to the lethal effect of X-rays and heavy ions. Int. J. Radiat. Biol. 8:589-603. 1964.
35. WYARD, S. J. On the spatial distribution of radicals produced by irradiation. Berkeley, California, University of California, Donner Laboratory and Donner Pavilion, UCRL 11387, p. 1-7. Sept. 1964.

1965

36. HENDRIKSEN, T. Effect of the irradiation temperature on the production of free radicals in solid biological compounds exposed to various ionizing radiations. Berkeley, California, University of California, Donner Laboratory and Donner Pavilion, UCRL 16281. July 20, 1965.



37. HENDRIKSEN, T. Free radical induced in enzymes by electrons and heavy ions. Berkeley, California, University of California, Donner Laboratory and Donner Pavilion, UCRL 16358. Aug. 23, 1965.
38. HENDRIKSEN, T. Production of free radicals in solid biological substances by heavy ions. Berkeley, California, University of California, Donner Laboratory and Donner Pavilion, UCRL 16280. July 20, 1965.
39. LYMAN, J. T. Acute cellular effects of heavy charged particle irradiations. Berkeley, California, University of California, Donner Laboratory and Donner Pavilion, UCRL 16456. Oct. 13, 1965.
40. McDONALD, L. W., KING, G. A., and TOBIAS, C. A. Radiosensitivity of the vestibular apparatus of the rabbit. Berkeley, California, University of California, Donner Laboratory and Donner Pavilion, UCRL 16246, p. 74-83. Sept. 1965.
41. ODA, N., and LYMAN, J. T. Secondary electron distribution for heavy ions. Berkeley, California, University of California, Donner Laboratory and Donner Pavilion, UCRL 16405. Sept. 15, 1965.
42. PATTERSON, W. H., and WALLACE, R. Report on a radiation survey made in Egypt, India, and Ceylon in January 1963. Berkeley, California, University of California, Donner Laboratory and Donner Pavilion, UCRL 10851 Rev. Oct. 1965.
43. RESCIGNO, A., and SEGRE, G. On some metric properties of the systems of compartments. Bull. Math. Biophys. 21:315-323. 1965.
44. SONDHAUS, C. A. Effect of high-energy protons and alpha particles on small mammals. In A. Reetz, Jr., ed. Second Symposium on Protection Against Radiations in Space, p. 97-103. Washington, D. C., National Aeronautics and Space Administration, 1965.
45. STEWARD, P. G. Results of computations of depth dose in tissue irradiated by protons. Berkeley, California, University of California, Donner Laboratory and Donner Pavilion, UCRL 16154. May 25, 1965.
46. TODD, P. W. Biological effects of heavy ions. In A. Reetz, Jr., ed. Second Symposium on Protection Against Radiations in Space, p. 105-114. Washington, D. C., National Aeronautics and Space Administration, 1965.
47. WALLACE, R., STEWARD, P. G., and SONDHAUS, C. Primary - and secondary - proton dose rates in spheres and slabs of tissue. In A. Reetz, Jr., ed. Second Symposium on Protection Against Radiations in Space, p. 301-329. Washington, D. C., National Aeronautics and Space Administration, 1965.

PRINCIPAL INVESTIGATOR TSUCHIYA, DR. H. M.  
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CONTRACT/GRANT TITLE: Developmental Program on Continuous  
Propagation of Hydrogen-Fixing  
Organism

1961

1. FREDRICKSON, A. G., BROWN, A. H., MILLER, R. L., and TSUCHIYA, H. M. Optimum conditions for photosynthesis in optimally dense cultures of algae. ARS J. 31:1429-1435. 1961.

1963

2. BAUER, W. G., FREDRICKSON, A. G., and TSUCHIYA, H. M. Mass transfer characteristics of a Venturi liquid-gas contactor. I & EC Process Design and Develop. 2:78-187. 1963.
3. FREDERICKSON, A. G., and TSUCHIYA, H. M. Continuous propagation of microorganisms. AIChE J. 9:459-468. 1963.

1964

4. MILLER, R. L., FREDRICKSON, A. G., BROWN, A. H., and TSUCHIYA, H. M. Hydromechanical method to increase efficiency of algal photosynthesis. I & EC Process of Design and Develop. 3:134-143. 1964.

1966

5. EAKMAN, J. M., FREDRICKSON, A. G., and TSUCHIYA, H. M. Statistics and dynamics of microbial cell populations. In American Institute of Chemical Engineers, 57th National Meeting, Minneapolis, Minnesota, Sept. 26-29, 1965, Chemical Engineering Progress, Symposium Series, No. 69, p. 37-49. 1966. 26 Refs.
6. HOWELL, J. A., FREDRICKSON, A. G., and TSUCHIYA, H. M. Optimal and dynamic characteristics of a continuous photosynthetic algal gas exchanger. AIChE, Chem. Eng. Prog., Symp. Ser., No. 68, p. 56-68. 1966. 15 Refs.
7. RAMKRISHNA, D., FREDRICKSON, A. G., and TSUCHIYA, H. M. Dynamics of microbial growth. a distributed structured model. J. Ferment. Tech. 44:210-217. 1966.

8. SWANSON, C. H., ARIS, R., FREDRICKSON, A. G., and TSUCHIYA, H. M. Bacterial growth as an optimal process. J. Theoret. Biol. 12(2):228-250. Nov. 1966. 16 Refs.
9. TSUCHIYA, H. M., FREDRICKSON, A. G., and ARIS, R. Dynamics of microbial cell populations. Adv. Chem. Eng. 6:124-205. New York, Academic Press. 1966.

1967

10. RAMKRISHNA, D., FREDRICKSON, A. G., and TSUCHIYA, H. M. Dynamics of microbial propagation: Models considering inhibitors and variable cell composition. Biotechnol. Bioeng. IX(2):129-170. April 1967. 32 Refs.

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CONTRACT/GRANT TITLE: Physiologic Response of Animals  
to Gaseous Environments in which  
Nitrogen is replaced by Inert Gases

1963

1. WEISS, H. S., WRIGHT, R. A., and HIATT, E. P. Incubation and hatching of chicken eggs in an atmosphere almost devoid of nitrogen. *Physiologist* 6(3):295. 1963.

1964

2. DINES, J. H., and HIATT, E. P. Prolonged exposure of young rats to an oxygen atmosphere at reduced pressure. *J. Appl. Physiol.* 10(1):17-20. 1964.
3. HIATT, E. P., WRIGHT, R. A., ALDEN, J., and WEISS, H. S. The effect of short periods of air breathing on oxygen toxicity in mice. *Physiologist* 7(3):159. 1964.
4. WEISS, H. S., PILMER, R. A., WRIGHT, R. A., WHARTON, C. R., and HIATT, E. P. Resistance of the chick to oxygen toxicity. *Fed. Proc.* 23(2):522. 1964.
5. WRIGHT, R. A., LESSLER, M. A., and WEISS, H. S. Metabolism and X-ray sensitivity of chick embryos incubated in a helium-oxygen atmosphere. *Aerosp. Med.* 35(3):284. 1964.

1965

6. RHOADES, R. A., WEISS, H. S., WRIGHT, R. A., and HIATT, E. P. Depression of metabolism in animals transferred from a helium-oxygen environment to air. *Fed. Proc.* 24(2):215. 1965.
7. WEISS, H. S., BECKMAN, D., and WRIGHT, R. A. Delayed mortality in the adult chicken exposed to one atmosphere oxygen. *Nature* 208:1003-1004. 1965.
8. WEISS, H. S., WRIGHT, R. A., and HIATT, E. P. Embryo development and chick growth in helium-oxygen environment. *Aerosp. Med.* 36(3):201-206. 1965.

9. WEISS, H. S., WRIGHT, R. A., and HIATT, E. P. Reaction of the chick to one atmosphere of oxygen. J. Appl. Physiol. 20(6):1227-1231. 1965.
10. WRIGHT, R. A., LESSLER, M. A., WEISS, H. S., and HIATT, E. P. Metabolism and X-ray sensitivity of chick embryos incubated in a helium-oxygen environment. Aerosp. Med. 36(4):311-314. 1965.

1966

11. BOWERS, R. W., MATHEWS, D. K., and FOX, E. L. Metabolic and thermal responses of man during exposure to He-O<sub>2</sub> and air gaseous mixtures. Physiologist 9(3):143. Aug. 1966.
12. FOX, E. L., BARTELS, R. L., and HIATT, E. P. Relationship of ambient temperature to body temperature of man in a He-O<sub>2</sub> atmosphere. Fed. Proc. 25(2, Pt. 1):273. 1966.
13. FOX, E. L., WEISS, H. S., BARTELS, R. L., and HIATT, E. P. Thermal responses of man during rest and exercise in a helium-oxygen environment. Arch. Environ. Health 13:23-28. 1966.
14. WEISS, H. S., WRIGHT, R. A., KREGLOW, E. S. and PITT, J. F. Resistance of the quail, Coturnix japonica, to oxygen toxicity: role of food intake. Physiologist 9(3):317. Aug. 1966.
15. WRIGHT, R. A., HIATT, E. P., and WEISS, H. S. Mortality and histopathology of germ-free rats and mice exposed to 100% oxygen. Proc. Soc. Exp. Biol. Med. 122(2):446-448. 1966. 11 Refs.
16. WRIGHT, R. A., KREGLOW, E. S., and WEISS, H. S. The effects of changing environmental factors in embryonic development in a He-O<sub>2</sub> atmosphere. Aerosp. Med. 37(3):309. 1966.
17. WRIGHT, R. A., WEISS, H. S., HIATT, E. P., and RUSTAGI, J. S. Risk of mortality in interrupted exposure to 100% oxygen: role of air vs. lowered pO<sub>2</sub>. Amer. J. Physiol. 210(5):1015-1020. 1966.
18. WRIGHT, R. W., WEISS, H. S., and RUSTAGI, J. S. Air vs. lowered pO<sub>2</sub> in interrupted exposure to 100% oxygen. Fed. Proc. 25(2, Pt. 1):566. 1966.

September 29, 1972

# communiqué

CONTRACTUAL LISTINGS OF PUBLICATIONS

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L. A. Kulp, Frances Hong, and  
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September 29, 1967

C. W. Shilling, M. D.  
Director

## PREFACE

This report lists publications resulting from research supported, at least in part, by the Exobiology Branch of the National Aeronautics and Space Administration's Bioscience Programs Division. A few publications, however, may predate the establishment of this office but are included because they resulted from efforts which were subsequently subsumed under this program branch. Each project, indexed alphabetically according to the principal investigator, supported organization and contract or grant number, reveals the published activity of each contractual endeavor. The more than 400 citations contained herein were provided in answer to a letter requesting such information from the principal investigator of the various grants and contracts monitored by this office. Only those papers currently available are included; publications in press have been omitted.

Research programs involving large expenditures of both effort and funding must be subjected to periodic evaluation in order to identify the current state-of-the-art for the respective field and to reveal the direction that such organized activities are taking. By this means, areas of critical need are recognized and remedied, and areas of increasingly limited interest are given appropriate attention. There are various methods for evaluating such programs only one of which is by the quantity of publications ensuing from a given activity or group of related activities. While in itself it is an inaccurate means for appraising either effort or accomplishment, combined with other factors it provides a useful measuring device. Submission of this report is made to provide some assistance in the constructive appraisal of the National Aeronautics and Space Administration's research activities in the field of exobiology.

Leslie A. Kulp, Ph.D.  
Senior Staff Scientist



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STANFORD UNIVERSITY	Blois, Dr. M. S.	NsG-218	12
STANFORD UNIVERSITY	Lederberg, Dr. J.	NsG-81	34
SMITHSONIAN ASTROPHYSICAL OBSERVATORY	Whipple, Dr. F.	NsG-291	63
WOODS HOLE OCEANOGRAPHIC INSTITUTE	Degens, Dr. E. T.	NSR 22-014-001	15
YALE UNIVERSITY	Lipsky, Dr. S. R.	NsG-192	39

PRINCIPAL INVESTIGATOR ALLEN, DR. R. D.  
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CONTRACT/GRANT NUMBER: NASr-159 (terminated)

CONTRACT/GRANT TITLE: Design and Construction of an Improved Optical  
Microscope System for Biological Research

1966

1. ALLEN, R. D., BRAULT, J. W., and ZEH, R. Image contrast and phase-modulated light methods in polarization and interference microscopy. In R. Barer and V. Cosslett, eds. Recent Advances in Optical and Electron Microscopy. New York, Academic Press, 1966.

PRINCIPAL INVESTIGATOR AMES RESEARCH CENTER  
AND ADDRESS: National Aeronautics and Space  
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Moffett Field, California 94035

1962

1. YOUNG, R. S. Exobiology. In Proceedings of the NASA-University Conference on the Science and Technology of Space Exploration, Chicago, Illinois 1:423. 1962.
2. YOUNG, R. S. Experimental biology in space. In E. Stuhlinger, ed. From Pennemunde to Outer Space, p. 791-803. New York, McGraw-Hill, 1962.

1963

3. OYAMA, V. I. Use of gas chromatography for the detection of life on Mars. Nature 200:1058-1059. 1963.
4. PONNAMPERUMA, C., LEMON, R. M., MARINER, R., and CALVIN, M. Formation of adenine by electron irradiation of methane, ammonia, and water. Proc. Nat. Acad. Sci. 49:737-740. 1963.
5. RASMUSSEN, R. E., and PAINTER, R. B. On the early onset of thymineless death occurring after exposure to ultraviolet light. Biochim. Biophys. Acta 76:157. 1963.
6. SAGAN, C., PONNAMPERUMA, C., and MARINER, R. Formation of adenosine by ultraviolet irradiation of a solution of adenine and ribose. Nature 198:1199. 1963.
7. SAGAN, C., PONNAMPERUMA, C., and MARINER, R. Ultraviolet synthesis of adenosine triphosphate under simulated primitive earth conditions. Smithsonian Astrophysical Observatory Special Report No. 128. July 10, 1963. 18 p.
8. YOUNG, R. S., DEAL, P., and ALLEN, J. The effect of diurnal freeze-thawing on survival and growth of selected bacteria. Nature 199:1078. 1963.

1964

9. GINOZA, H. S., and PAINTER, R. B. Genetic recombination between the resistance transfer factor and the chromosome of Escherichia coli. J. Bacteriol. 87:1339. 1964.
10. PAINTER, R. B., and RASMUSSEN, R. E. Organization of the deoxyribonucleic acid synthesizing system in mammalian cells as revealed by the use of x-radiation and bromuracil deoxyriboside. Nature 201:162. 1964.
11. PAINTER, R. B., and RASMUSSEN, R. E. A pitfall of low specific activity radioactive thymidine. Nature 201:409. 1964.



12. PONNAMPERUMA, C. Chemical evolution and the origin of life. *Nature* 201:337. 1964.
13. PONNAMPERUMA, C., and KIRK, P. Synthesis of deoxyadenosine under simulated primitive earth conditions. *Nature* 203:400-401. 1964.
14. PONNAMPERUMA, C., KIRK, P., MARINER, R., and TYSON, B. A coincidence technique for paper chromatography. *Nature* 202:393. 1964.
15. PONNAMPERUMA, C., and WOELLER, F. Differences in the character of C<sub>6</sub> to C<sub>9</sub> hydrocarbons from gaseous methane in low-frequency electric discharges. *Nature* 203:272. 1964.
16. PONNAMPERUMA, C., YOUNG, R. S., MUNOZ, E., and McCRAW, B. K. Guanine: formation during the thermal polymerization of amino acids. *Science* 143:1449. 1964.
17. RASMUSSEN, R. E., and PAINTER, R. B. Evidence for repair of ultra-violet light damaged DNA in cultured mammalian cells. *Nature* 203:1360. 1964.
18. YOUNG, R. S., DEAL, P. H., BELL, J., and ALLEN, J. L. Bacteria under simulated Martian conditions. In M. Florkin and A. Dollfus, eds. *Life Sciences and Space Research, II*, p. 105-111. Amsterdam, North-Holland Publ. Co., 1964.
19. YOUNG, R. S., and PONNAMPERUMA, C. Early evolution of life. In W. Auffenberg, ed. *American Institute of Biological Sciences, Biological Sciences Curriculum Study, Pamphlet No. 11*. Boston, D. C. Heath and Co., 1964. 30 p.
20. YOUNG, R. S., and PONNAMPERUMA, C. Life: origin and evolution. Meeting report to *Science* 143:384. 1964.

1965

21. FROMMHAGEN, L. H. The level and specificity of antibodies evoked by crude and purified enterovirus antigens. *J. Bacteriol.* 1965.
22. FROMMHAGEN, L. H. The separation and physicochemical properties of C and D antigens of Coxsacki virus. *J. Immunol.* 1965.
23. FROMMHAGEN, L. H. Similarities of biophysical properties of several human enteroviruses as shown by density gradient ultracentrifugation of mixtures of the viruses. *Virology* 25:4. 1965.
24. HOWARD, S. M., and HEINRICH, M. R. The anomeric specificity of yeast galactokinase. *Arch. Biochem. Biophys.* 110:395. 1965.
25. KLEIN, H. P. Nature of particles involved in lipid synthesis in yeast. *J. Bacteriol.* 90:227-234. 1965.

26. PAINTER, R. B., and RASMUSSEN, R. E. Conditions affecting the early thymineless death occurring after ultraviolet irradiation of Escherichia coli B3. Photochem. Photobiol. 4:61. 1965.
27. POLLOCK, G. E., OYAMA, V. I., and JOHNSON, R. D. Resolution of racemic amino acids by gas chromatography. J. Gas Chromatogr. 3(5):174-176. 1965.
28. PONNAMPERUMA, C. Abiological synthesis of some nucleic acid constituents. In S. W. Fox, ed. The Origins of Prebiological Systems and Their Molecular Matrices, p. 221. New York, Academic Press, 1965.
29. PONNAMPERUMA, C. Chemical studies on the origin of life. In Proceedings of the Virginia Polytechnic Institute Conference on the Exploration of Mars and Venus, Virginia Polytechnic Institute, Va., Aug. 23-27, 1965, p. VII-1 - VII-8. Blacksburg, Va., Virginia Polytechnic Institute, 1965. 18 Refs.
30. PONNAMPERUMA, C. Experimental approach to the origin of life. Sci. Amer. 1965.
31. PONNAMPERUMA, C. Life in the universe - intimations and implications for space science. Astron. Aeronaut. 3:66-69. Oct. 1965.
32. PONNAMPERUMA, C., and MACK, R. Nucleotide synthesis under possible primitive earth conditions. Science 148:1221. 1965.
33. PONNAMPERUMA, C., and PETERSON, E. Peptide synthesis from amino acids and aqueous solution. Science 147:1572. 1965.
34. WHITE, D., and KLEIN, H. P. Factors affecting fatty acid synthesis in cell-free preparations from Saccharomyces cerevisiae. Biochem. Biophys. Res. Commun. 20(1):78-84. 1965.
35. YOUNG, R. S. Automated life detection. Astron. Aeron. 3:70-76. Oct. 1965.
36. YOUNG, R. S. Morphology and chemistry of microspheres from proteinoid. In S. W. Fox, ed. The Origins of Prebiological Systems and of Their Molecular Matrices, p. 347-357. New York, Academic Press, 1965.
37. YOUNG, R. S., PAINTER, R. B., and JOHNSON, R. D., eds. An analysis of the extraterrestrial life detection problem. Washington, D. C., National Aeronautics and Space Administration, 1965. 36 p. (NASA SP-75)
38. YOUNG, R. S., PONNAMPERUMA, C., and McCRAW, B. Abiogenic synthesis on Mars. In M. Florkin, ed. Life Sciences and Space Research, III, p. 127-138. Amsterdam, North-Holland Publ. Co., 1965.

PRINCIPAL INVESTIGATOR ANDERS, DR. E.  
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The Enrico Fermi Institute  
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CONTRACT/GRANT NUMBER: NsG-366

CONTRACT/GRANT TITLE: Investigation of the Origin, Age and  
Composition of Meteorites

1963

1. FITCH, F., and ANDERS, E. Organized element: possible identification in Orgueil meteorite. Science 140(3571):1097-1100. 1963.

1964

2. ANDERS, E. Origin, age, and composition of meteorites. Space Sci. Rev. 3:583. 1964.
3. ANDERS, E., DU FRESNE, E. R., HAYATSU, R., DU FRESNE, A., CAVAILLE, A., and FITCH, F. W. Contaminated meteorite. Science 146:1157. 1964.
4. HAYATSU, R. Orgueil meteorite: organic nitrogen contents. Science 146:1291-1293. 1964.

1965

5. ANDERS, E., and ARNOLD, J. R. Age of craters on Mars. Science 149:1494. 1965.
6. HAYATSU, R. Search for optical activity in the Orgueil meteorite. Science 149:443. 1965.
7. MONSTER, J., ANDERS, E., and THODE, H. S34/S32 ratios for the different forms of sulphur in the Orgueil meteorite and their mode of formation. Geochim. Cosmochim. Acta 29:773. 1965.
8. STUDIER, M. H., HAYATSU, R., and ANDERS, E. Organic compounds in carbonaceous chondrites. Science 149:1455. 1965.

1966

9. HAYATSU, R. Artifacts in polarimetry and optical activity in meteorites. Science 153:859-861. Aug. 19, 1966. 12 Refs.
10. STUDIER, M. H., HAYATSU, R., and ANDERS, E. Reply to Urey and Lewis' "Some comments on a recent hypothesis on carbon compounds in carbonaceous chondrites". Science 152:106-107. 1966.

PRINCIPAL INVESTIGATOR BIEMANN, DR. K.  
AND ADDRESS: Massachusetts Institute of Technology  
Department of Chemistry  
Cambridge, Massachusetts 02139

CONTRACT/GRANT NUMBER: NsG-211

CONTRACT/GRANT TITLE: Identification of Organic Matter by  
Mass Spectrometry

1962

1. BIEMANN, K., and McCLOSKEY, J. A. Application of mass spectrometry to structure problems. VI. Nucleosides. J. Amer. Chem. Soc. 84:2005. 1962.
2. BIEMANN, K., and McCLOSKEY, J. A. Mass spectra of organic molecules. II. Amino acids. J. Amer. Chem. Soc. 84:3192. 1962.

1964

3. BIEMANN, K. Mass spectrometry. Proceedings of the Welch Foundation Conference on Chemical Research, Houston, Texas, Nov. 1963, VII. p. 199-232. 1964.

1965

4. BIEMANN, K. Detection and identification of biologically significant compounds by mass spectrometry. In M. Florkin, ed. Life Sciences and Space Research, III, p. 77-85. Amsterdam, North-Holland Publ. Co., 1965.
5. BIEMANN, K., and McMURRAY, W. J. Computer-aided interpretation of high resolution mass spectra. Tetrahedron Letters No. 11:647. 1965.

PRINCIPAL INVESTIGATOR BLEI, DR. I.  
AND ADDRESS: Melpar, Incorporated  
Falls Church, Virginia

CONTRACT/GRANT NUMBER: NASw-557 (terminated)

CONTRACT/GRANT TITLE: Detection of Extraterrestrial Life by  
Optical Rotation

1965

1. BLEI, I., and LISKOWITZ, J. W. Review of concepts and investigations for the use of optical rotation as a means of detecting extraterrestrial life. In M. Florkin, ed. Life Sciences and Space Research, III, p. 86-94. Amsterdam, North-Holland Publ. Co., 1965.

PRINCIPAL INVESTIGATOR BLOIS, DR. M. S.  
AND ADDRESS: Stanford University  
Stanford Medical Center  
Department of Dermatology  
Palo Alto, California 94304

CONTRACT/GRANT NUMBER: NsG-218

CONTRACT/GRANT TITLE: Molecular Evolution in Protobiological  
Systems, including a Search for Catalysts  
and Catalytic Activity in the Intermediate  
Systems which form during the Syntheses  
of Low Molecular Weight Organic Compounds

1965

1. BLOIS, M. S. Random polymer as a matrix for chemical evolution. In  
S. Fox, ed. The Origins of Prebiological Systems and of their  
Molecular Matrices, p. 19-38. New York, Academic Press, 1965.

PRINCIPAL INVESTIGATOR CALVIN, DR. M.  
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Department of Chemistry  
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Berkeley, California 94720

CONTRACT/GRANT NUMBER: NsG-101

CONTRACT/GRANT TITLE: Refraction Spectra, Meteorite Analysis  
and Chemical Evolution

1963

1. DANIELSON, R. E. The first flight of Stratoscope II. Amer. Scientist 51:375. 1963.

1964

2. DANIELSON, R. E., GAUSTAD, J. E., SCHWARZSCHILD, M., WEAVER, H. F., and WOOLF, N. J. Mars observations from Stratoscope II. Astron. J. 69(5):344. 1964.
3. EGLINTON, G., SCOTT, P. M., BELSKY, T., BURLINGAME, A. L., and CALVIN, M. Hydrocarbons of biological origin from a one-billion year old sediment. Science 145:263-264. 1964.

1965

4. BELSKY, T., JOHNS, R. B., MCCARTHY, E. J., BURLINGAME, A. L., RICHTER, W., and CALVIN, M. Evidence for life processes in a sediment two and a half billion years old. Nature 206:446-447. 1965.
5. BURLINGAME, A. L., HAUG, P., BELSKY, T., and CALVIN, M. Occurrence of biogenic steranes and penta-cyclic triterpanes in an Eocene shale (52 million years) and in an early Precambrian shale (2.7 billion years): a preliminary report. Proc. Nat. Acad. Sci. 54:1406. 1965.
6. CALVIN, M. Chemical evolution (the Bakerian Lecture). Proc. Roy. Soc. (London), Ser. A, 288:441-466. Nov. 30, 1965. 59 Refs.
7. RICHTER, W., SENN, M., and BURLINGAME, A. L. Convenient labeling technique for mass spectrometry: acid catalyzed deuterium and oxygen-18 exchange via gas-liquid chromatography. Tetrahedron Letters No. 17:1235. 1965.
8. SENN, M., RICHTER, W., and BURLINGAME, A. L. Convenient deuterium labeling for mass spectrometry via exchange of enolizable hydrogen on a GLC column. J. Amer. Chem. Soc. 87:680. 1965.

1966

9. CALVIN, M. Chemical evolution. In R. Riley, ed. Proceedings of the Tenth International Botanical Congress, 1964. p. 41-46. New York, Plenum Press, 1966.
10. EGLINTON, G., SCOTT, P M., BELSKY, T., BURLINGAME, A. L., RICHTER, W., and CALVIN, M. Occurrence of isoprenoid alkanes in a Pre-cambrian sediment. In G. D. Hobson and M. C. Louis, eds. Advances in Organic Geochemistry, 1964, p. 41-74. London, Pergamon Press, 1966.
11. JOHNS, R. B., BELSKY, T., MCCARTHY, E. J., BURLINGAME, A. L., HAUG, P., SCHNOES, H., RICHTER, W., and CALVIN, M. II. The organic geochemistry of ancient sediments. Geochim. Cosmochim. Acta 30: 1191-1222. Dec. 1966. 68 Refs.



PRINCIPAL INVESTIGATOR DEGENS, DR. E. T.  
AND ADDRESS: Woods Hole Oceanographic Institute  
Woods Hole, Massachusetts 02543

CONTRACT/GRANT NUMBER: NSR 22-014-001

CONTRACT/GRANT TITLE: Biogeochemistry of Terrestrial and Extra-  
terrestrial Organic Matter

1965

1. DEGENS, E. T., and LOVE, S. Comparative studies of amino acids in shell structures of Gyraulus trochiformis STAHL, from the tertiary of Steinheim, Germany. *Nature* 205:876-878. 1965.
2. DEGENS, E. T., and PARKER, R. H. Significance of shell protein variation to environment and molluscan phylogeny. (Abstr.) *Bull. Geol. Soc. Amer.*, Meeting Kansas City 1965, p. 43. 1965.

1966

3. DEGENS, E. T., and SCHMIDT, H. Die Palaobiochemie, ein neues Arbeitsgebiet der Evolutionsforschung. [Paleobiochemistry, a new area of evolution research]. *Palaeontol. Z.* 40:218-229. 1966.
4. DEGENS, E. T., and SPENCER, D. W. Data file on amino acid distribution in calcified and uncalcified tissues of shell-forming organisms. Technical Report, Woods Hole Oceanographic Institution, No. 66-27. 1966.
5. DEGENS, E. T., SPENCER, D. W., and PARKER, R. H. Paleobiochemistry of molluscan shell proteins. *Comp. Biochem. Physiol.* 19:111-138. 1966.
6. KELEMEN, S. P., and DEGENS, E. T. Rapid column chromatography of purine and pyrimidine bases on "ectaola" cellulose at room temperature and elevated pressure. *Nature* 211:857-859. 1966.
7. SIEGEL, A., and DEGENS, E. T. Concentration of dissolved amino acids from saline waters by ligand-exchange chromatography. *Science* 151:1098-1101. 1966.

PRINCIPAL INVESTIGATOR FLETCHER, DR. D. W.  
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CONTRACT/GRANT NUMBER: NAs 2-2811

CONTRACT/GRANT TITLE: Screening of Organisms for Survival and  
Growth under Diurnal Freeze-Thaw Cycling

1966

1. ISHIGURO, E., and FLETCHER, D. W. Morphogenesis of a Mycrococcus-like organism. Bacteriol. Proc. p. 24(G48). 1966.

PRINCIPAL INVESTIGATOR FOX, DR. S. W.  
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Institute of Molecular Evolution  
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Coral Gables, Florida 33134

CONTRACT/GRANT NUMBER: NsG-689

CONTRACT/GRANT TITLE: Molecular Evolution and Extraterrestrial  
Environments

1961

1. FOX, S. W., and HARADA, K. Synthesis of uracil under conditions of a thermal model of prebiological chemistry. Science 133:1923-1924. 1961.

1962

2. BISCHOFF, E. R., and METZ, C. B. Immunological identification of an egg agglutinin in Arbacia sperm extracts. Biol. Bull. 123(2): 471. 1962.
3. BISCHOFF, E. R., and METZ, C. B. Neutralization of the fertilization inhibitors in anti-Arbacia-sperm serum by sperm extracts. Biol. Bull. 123(2):470. 1962.
4. FLAKE, G., and METZ, C. B. Soluble surface and subsurface antigens of the Arbacia sperm. Biol. Bull. 123(2):472. 1962.
5. FOX, S. W., HARADA, K., and ROHLFING, D. L. The thermal copolymerization of  $\alpha$ -amino acids. In M. A. Stahmann, ed. Polyamino Acids, Peptides and Proteins. Proceedings of an International Symposium held at the University of Wisconsin, 1961. p. 47-54. Madison, The University of Wisconsin Press, 1962.
6. FRANKLIN, L., and METZ, C. B. Electron microscope study of sperm entry into sea urchin oocytes. Biol. Bull. 123(2):473. 1962.
7. HARADA, K., and FOX, S. W. A total resolution of aspartic acid copper complex by inoculation. Nature 194:768. 1962.
8. METZ, C. B. Immunochemical studies on fertilization mechanisms. In Proceedings of the Conference on Immuno-Reproduction. Population Council, New York. 1962.
9. SHIVERS, C. A., and METZ, C. B. Inhibition of fertilization in frog eggs by univalent fragments of rabbit antibody. Proc. Soc. Exp. Biol. Med. 110(2):385-387. 1962.
10. SHIVERS, C. A., and METZ, C. B. Localization of sperm antigens by dissociation of antigen-antibody precipitates. Biol. Bull. 123(2): 474. 1962.

11. VEGOTSKY, A., and FOX, S. W. Protein molecules: intraspecific and interspecific variations. In M. Florkin and H. S. Mason, eds. Comparative Biochemistry 4:185-244. New York, Academic Press, 1962.

1963

12. AUSTIN, C. R. Gametogenesis and fertilization in the mesozoon Dicyema aegira. Parasitology 54:597-600. 1963.
13. FOX, S. W. Experiments suggesting origins of amino acids and proteins. Proc. Symp. Protein Nutr. Metab., Urbana, Ill., 1962, p. 141-154. 1963.
14. FOX, S. W. The outlook for synthetic foods. Food Technol. 22: 388-392. 1963.
15. FOX, S. W. Prebiological formation of biochemical substances. In I. A. Breger, ed. Organic Geochemistry, p. 36-49. New York, Pergamon Press, 1963.
16. FOX, S. W., and HARADA, K. Experiments related to the chemical origins of proteins. In G. H. Bourne, ed. Medical and Biological Problems of Space Flight; Proceedings of a conference held in Nassau, the Bahamas, Nov. 1961, p. 261-270. New York, Academic Press, 1963.
17. FOX, S. W., and HARADA, K. Titration and c-terminal analysis of thermal polyamino acids. Fed. Proc. 22:479. 1963.
18. FOX, S. W., HARADA, K., WOODS, K. R., and WINDSOR, C. R. Amino acid compositions of proteinoids. Arch. Biochem. Biophys. 102:439-445. 1963.
19. FOX, S. W., HAYAKAWA, T., and HARADA, K. The synthesis of  $\alpha$ -L-aspartyl-L-serylglycine. Bull. Chem. Soc. Japan 36:1050-1051. 1963.
20. FOX, S. W., and YUYAMA, S. Abiotic production of primitive protein and formed microparticles. Ann. N. Y. Acad. Sci. 108:487-494. 1963.
21. FOX, S. W., and YUYAMA, S. Effects of the gram stain on microspheres from thermal polyamino acids. J. Bacteriol. 85:279-283. 1963.
22. HARADA, K. Asymmetric synthesis of  $\alpha$ -amino acids by the Strecker synthesis. Nature 200:1201. 1963.
23. KLOETZEL, J. A., and METZ, C. B. Studies on the soluble antigens of the sperm of Arbacia punctulata. Biol. Bull. 125(2):363-364. 1963.
24. MANN, T. 5-Hydroxytryptamine in the spermatophoric sac of the octopus. Nature 199(4898):1066-1067. 1963.

25. MANN, T., and MANN, C. L. Comparative biochemical aspects of animal reproduction. Bull. Acad. Roy. Med. Belgique 3:563-593. 1963.
26. WILLIAMS, D. E., and METZ, C. B. Inhibition of fertilization by specific antibodies dissociated from sperm. Biol. Bull. 125(2): 365. 1963.

1964

27. FOX, S. W. Experiments in molecular evolution and criteria of extra-terrestrial life. Bioscience 14:13-21. 1964.
28. FOX, S. W. A model of abiogenesis and the origin of memory at the molecular level. In M. A. B. Brazier, ed. Brain Function: Volume II, RNA and Brain Function: Memory and Learning, p. 21-25. Berkeley, University of California Press, 1964.
29. FOX, S. W. Prebiological formation of biochemical substances. In U. Colombo and G. Hobson, eds. Advances in Organic Chemistry, Proceedings, p. 36-49. New York, Pergamon Press, 1964.
30. FOX, S. W. Thermal polymerization of amino acids and production of formed microparticles on lava. Nature 201:336-337. 1964.
31. FOX, S. W., and FUKUSHIMA, T. Electron micrographs of microspheres from thermal proteinoid. In W. L. Kretovich, ed. Problems of Evolutionary and Industrial Biochemistry, p. 93-100. Moscow, A. N. Back Institute of Biochemistry, Academy of Sciences, 1964.
32. FOX, S. W., HARADA, K., KRAMPITZ, G., HAYAKAWA, T., and WINDSOR, C. R. Chemical synthesis of proteinoids. Part I. In NASA, Washington Conference on Nutrition in Space and Related Waste Problems, p. 331-338. 1964.
33. FOX, S. W., and KRAMPITZ, G. The catalytic decomposition of glucose in aqueous solution by thermal proteinoids. Nature 203:1362-1364. 1964.
34. FOX, S. W., and YUYAMA, S. Dynamic phenomena in microspheres from thermal proteinoid. Comp. Biochem. Physiol. 11:317-321. 1964.
35. HARADA, K. Direct resolution of DL-aspartic acid by use of optically active amine. Bull. Chem. Soc. Japan 37:1383-1384. 1964.
36. HARADA, K., and FOX, S. W. Stereospecific synthesis of an optically active  $\alpha$ -amino acid. Naturwissenschaften 51:106-107. 1964.
37. HARADA, K., and FOX, S. W. Thermal synthesis of natural amino acids from a postulated primitive terrestrial atmosphere. Nature 201: 335-336. 1964.
38. HARADA, K., and HAYAKAWA, T. Synthesis of  $\alpha$ -amino acid menthyl esters. Bull. Chem. Soc. Japan 37:191-194. 1964.

39. MENZEL, M. Y. Preferential chromosome pairing in allotetraploid Lycopersicon esculentum-Solanum lycopersicoides. Genetics 50: 855. Nov. 1964.
40. MENZEL, M. Y., and PRICE, J. M. Fine structure of pachytene nuclei in the intergeneric hybrid Lycopersicon esculentum-Solanum lycopersicoides. Amer. J. Bot. 51:671. July 1964.
41. METZ, C. B., SCHUEL, H., and BISCHOFF, E. R. Inhibition of the fertilizing capacity of sea urchin sperm by papain-digested non-agglutinating antibody. J. Exp. Zool. 155:261-272. 1964.
42. SCHWARTZ, A., and FOX, S. W. Thermal synthesis of internucleotide phosphodiester linkages. Biochim. Biophys. Acta 87:696-698. 1964.
43. SHIVERS, C. A., METZ, C. B., and LUTWAK-MANN, C. Some properties of pig follicular fluid. J. Reprod. Fert. 8:115-120. 1964.

1965

44. AUSTIN, C. R. Fine structure of the snake sperm tail. J. Ultrastruct. Res. 12:452-462. 1965.
45. FOX, S. W. Experiments suggesting evolution to protein. In B. Bryson and H. J. Vogel, eds. Evolving Genes and Proteins, p. 359-369. New York, Academic Press, 1965.
46. FOX, S. W., ed. The origins of prebiological systems and of their molecular matrices. New York, Academic Press, 1965. 482 p.
47. FOX, S. W. Simulated natural experiments in spontaneous organization of morphological units from proteinoid. In S. W. Fox, ed. The Origins of Prebiological Systems and Their Molecular Matrices, p. 361-382. New York, Academic Press, 1965.
48. FOX, S. W. A theory of macromolecular and cellular origins. Nature 205:328-340. 1965.
49. FRANKLIN, L. E. Morphology of gamete membrane fusion and of sperm entry in oocytes of the sea urchin. J. Cell Biol. 25(2, Pt. 2): 81-100. 1965.
50. HARADA, K. Optical resolution of D, L, amino acid by a stereoselective ligand exchange reaction. Nature 205:590-591. 1965.
51. HARADA, K. Optical resolution of DL-aspartic acid, DL-glutamic acid, DL-asparagine, and DL-glutamine by preferential crystallization. Bull. Chem. Soc. Japan 38:1552-1555. 1965.
52. HARADA, K. The total optical resolution of free  $\alpha$ -amino acids by the inoculation method. Nature 206:1354-1355. 1965.

53. HARADA, K., and FOX, S. W. Characterization of thermal polymers of neutral  $\alpha$ -amino acids with dicarboxylic amino acids or lysine. Arch. Biochem. Biophys. 109:49-56. 1965.
54. HARADA, K., and FOX, S. W. Thermal polycondensation of free amino acids with polyphosphoric acid. In S. W. Fox, ed. The Origins of Prebiological Systems and Their Molecular Matrices, p. 289-298. New York, Academic Press, 1965.
55. HARADA, K., and FOX, S. W. The thermal synthesis of amino acids from a hypothetically primitive terrestrial atmosphere. In S. W. Fox, ed. The Origins of Prebiological Systems and Their Molecular Matrices, p. 187-201. New York, Academic Press, 1965.
56. HAYAKAWA, T., and HARADA, K. Synthesis of  $\alpha$ -amino acid menthyl esters (II). Bull. Chem. Soc. Japan 38:1354-1358. 1965.
57. SCHWARTZ, A., BRADLEY, E., and FOX, S. W. Thermal condensation of cytidylic acid in the presence of polyphosphoric acid. In S. W. Fox, ed. The Origins of Prebiological Systems and Their Molecular Matrices, p. 317-326. New York, Academic Press, 1965.
58. VEGOTSKY, A., HARADA, K., and FOX, S. W. Origin of life. In McGraw Yearbook of Science and Technology, p. 243. New York, McGraw-Hill Co., 1965.

1966

59. BROWN, G. G. Ultrastructural studies of sperm morphology and sperm-egg interaction in the decapod Callinectes sapidus. J. Ultrastruct. Res. 14:425-440. 1966.
60. FOX, S. W. Colloquium on elementary biological systems and abiogenesis. Bioscience 16:480-481. 1966.
61. FOX, S. W. Development of rigorous tests for extraterrestrial life. In C. S. Pittendrigh, W. Vishniac, and J. P. T. Pearman, eds. Biology and the Exploration of Mars, p. 213-226. Washington, D. C., Nat. Acad. Sci. - Nat. Res. Council, 1966. (Publ. 1296)
62. FOX, S. W. Experiments with a precellular model. Proceedings of the Conference on Theoretical Biology, p. 121-138. 1966. (NASA SP-104)
63. FOX, S. W. How did life begin? In E. A. Shneour and E. A. Ottesen, comp. Extraterrestrial Life, p. 48-64. Washington, D. C., Nat. Acad. Sci. - Nat. Res. Council, 1966. (Publ. 1296A)
64. FOX, S. W., and HARADA, K. Thermal polycondensation of  $\alpha$ -amino acids. In P. Alexander and H. P. Lundgren, eds. A Laboratory Manual of Analytical Methods of Protein Chemistry, p. 127-151. New York, Pergamon Press, 1966.

65. FOX, S. W., McCAULEY, R. J., JOSEPH, D., WINDSOR, C. R., and YUYAMA, S. Simulation of organismic morphology and behavior by synthetic poly- $\alpha$ -amino acids. In Life Sciences and Space Research, IV, p. 111-120. Spartan Books, 1966.
66. HARADA, K. Optical resolution and absolute configuration of trans-phenylglycidic acid. J. Org. Chem. 31:1407-1410. 1966.
67. HAYAKAWA, T., HARADA, K., and FOX, S. W. The synthesis of some peptides related to the active site of enzymes. Bull. Chem. Soc. Japan 39:391-395. 1966.
68. MATSUMOTO, K., and HARADA, K. Stereoselective syntheses of optically active amino acids from menthyl esters of  $\alpha$ -keto acids. J. Org. Chem. 31:1956-1958. 1966.
69. MENZEL, M. Y., and PRICE, J. M. Fine structure of synapsed chromosomes in Fl Lycopersicon esculentum-Solanum lycopersicoides and its parents. Amer. J. Bot. 53(10):1079-1086. Nov.-Dec. 1966. 26 Refs.

1967

70. HAYAKAWA, T., WINDSOR, C. R., and FOX, S. W. Copolymerization of the leuchs anhydrides of the eighteen amino acids common to protein. Arch. Biochem. Biophys. 118(2):265-272. Feb. 1967. 29 Refs.
71. METZ, C. B. Gamete surface components and their role in fertilization. In C. B. Metz and A. Monroy, eds. Fertilization: Comparative Morphology, Biochemistry, and Immunology, Vol. 1, Ch. 5. New York, Academic Press, 1967.
72. ROHLFING, D. L., and FOX, S. W. The inactivation of catalytically active thermal polyanhydro- $\alpha$ -amino acids. Arch. Biochem. Biophys. 118:127-132. Jan. 1967. 30 Refs.
73. ROHLFING, D. L., and FOX, S. W. The catalytic activity of thermal polyanhydro- $\alpha$ -amino acids for the hydrolysis of P-nitrophenyl acetata - catalysis by thermal polyamino acids. Arch. Biochem. Biophys. 118: 122-126. Jan. 1967. 43 Refs.
74. WAEHNELDT, T. V., and FOX, S. W. Phosphorylation of nucleosides with polyphosphoric acid. Biochim. Biophys. Acta 134:1-8. 1967.



PRINCIPAL INVESTIGATOR GAFFRON, Dr. H.  
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CONTRACT/GRANT NUMBER: NGR 10-004-018

CONTRACT/GRANT TITLE: Photochemical Transformation of  
Acetate into Algae Cell Material

1966

1. KOWALLIK, W. Chlorophyll independent photochemistry in algae. In  
Energy Conversion by the Photosynthetic Apparatus, Symposium No.  
19, Brookhaven National Laboratory, Upton, New York, 1966. p. 467-  
477.
2. KOWALLIK, W., and GAFFRON, H. Respiration induced by Blue Light.  
Planta 69:92-95. 1966.

PRINCIPAL INVESTIGATOR GODDARD SPACEFLIGHT CENTER  
AND ADDRESS: National Aeronautics and Space  
Administration  
Greenbelt, Maryland

1962

1. LEVIN, G. V., and CARRIKER, A. W. Life on Mars? Nucleonics 20(10): 71-72. 1962.
2. LEVIN, G. V., HEIM, A. H., CLENDENNING, J. R., and THOMPSON, M. F. "Gulliver" - a quest for life on Mars. Science 138:114. 1962.

1963

3. LEVIN, G. V. Rapid microbiological determinations with radioisotopes. In W. W. Umbreit, ed. Advances in Applied Microbiology, 5:95-132. New York, Academic Press, 1963.
4. LEVIN, G. V., HEIM, A. H., CLENDENNING, J. R., and THOMPSON, M. F. Radioisotope metabolic detection of possible Martian life forms. Proc. 12th Lun. Plan. Expl. Colloq. 3(2):37-45. May 5, 1963.

1964

5. LEVIN, G. V., HEIM, A. H., THOMPSON, M. F., HOROWITZ, N. H., and BEEM, D. R. "Gulliver" - an experiment for extraterrestrial life detection and analysis. In M. Florkin and A. Dollfus, eds. Life Sciences and Space Research, II, p. 124-132. Amsterdam, North-Holland Publ. Co., 1964.

1965

6. LEVIN, G. V., and HEIM, A. H. Gulliver and Diogenes-exobiological antitheses. In M. Florkin, ed. Life Sciences and Space Research, III, p. 105-119. Amsterdam, North-Holland Publ. Co., 1965.

PRINCIPAL INVESTIGATOR HESS, DR. S. L.  
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CONTRACT/GRANT NUMBER: NsG-173

CONTRACT/GRANT TITLE: Physical Study of Planetary Atmospheres  
and Conditions Related to Possibility  
of Life on the Planets

1963

1. HESS, S. L. Remarks on the meteorology of Mars. (From a symposium on the exploration of Mars). Proc. Amer. Astronaut. Soc. 15: 596. June 6-7, 1963.

PRINCIPAL INVESTIGATOR JET PROPULSION LABORATORY  
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1962

1. CAMERON, R. E. Soil studies - microflora of desert regions. Calif. Inst. Tech. Jet Propulsion Lab. Space Progr. Sum. 37-15, 4:12-20. 1962.
2. HOBBY, G. L. Review of the NASA-JPL S/C sterilization program. In A Review of Space Research. Nat. Acad. Sci. - Nat. Res. Counc. Publ. 1079, Ch. 10, Appendix III. Washington, D. C., Nat. Acad. Sci., 1962.
3. MORELLI, F. Tests of resins and potting compounds for sporicidal activity. Calif. Inst. Tech. Jet Propulsion Lab. Res. Sum. 36-12, 1:14-16. 1962.
4. MORELLI, F., FEHLNER, F., and STEMBRIDGE, C. Effects of ultra-high vacuum on Bacillus subtilis variety niger. Nature 196(4850): 106-107. 1962.

1963

5. CAMERON, R. E., and BLANK, G. B. Autoclave colorimetric method for soil organic matter. Calif. Inst. Tech. Jet Propulsion Lab. Space Progr. Sum. 37-21, 4:253-254. 1963.
6. CAMERON, R. E., and BLANK, G. B. Soil organic matter. Calif. Inst. Tech. Jet Propulsion Lab. Tech. Rept. 32-443. 14 p. 1963.
7. HOBBY, G. L. Exobiological instrumentation. In Proc. 12th Intern. Astronaut. Congress, p. 813. New York, Academic Press, 1963.
8. HOBBY, G. L. Extraterrestrial life. In Encyclopedia of Sciences and Technology, p. 247-249. New York, McGraw-Hill, 1963.
9. HOBBY, G. L. Spacecraft sterilization. Proc. 12th Lun. Plan. Expl. Colloq. 3(2):49-51. May 5, 1963.
10. MAMIKUNIAN, G., and BRIGGS, M. Catalog of microstructures observed in carbonaceous chondrites. Calif. Inst. Tech. Jet Propulsion Lab. Tech. Rept. 32-398. 75 p. Mar. 15, 1963.
11. MAMIKUNIAN, G., and BRIGGS, M. Organic constituents of the carbonaceous chondrites. Space Sci. Rev. 1(4):647-682. 1963.

12. MAMIKUNIAN, G., and BRIGGS, M. Organized elements in carbonaceous chondrites. *Science* 139(3558):873. Mar. 8, 1963.
13. MAMIKUNIAN, G., and BRIGGS, M. Some microstructures of complex morphology observed in preparations of carbonaceous chondrites under sterile conditions. *Nature* 197:1245-1248. 1963.
14. MAMIKUNIAN, G., and BRIGGS, M. Venus: a summary of present knowledge. *J. Brit. Interplanet. Soc.* 19:2. 1963.
15. RHO, J., and BEHAR, J. Fluorometric measurements of growth. I. Fluorescence of chlorophyll as a measure of algal growth. *Calif. Inst. Tech. Jet Propulsion Lab. Space Progr. Sum.* 37-34, 4:262-269. 1963.
16. RHO, J. Fluorometric measurements of growth. II. Fluorescence of proteins as a measure of bacterial growth. *Calif. Inst. Tech. Jet Propulsion Lab. Space Progr. Sum.* 37-25, 4:243-250. 1963.
17. SOFFEN, G. A. Implication of morphology in the investigation of extraterrestrial life. *Amer. Biol. Teacher* 25(7):536-538. Nov. 1963.
18. SOFFEN, G. A. Simple vidicon microscopy. *Proc. 12th Lun. Plan. Expl. Colloq.* 3(2):47-48. 1963.
19. WILHITE, W. F., and BURNELL, M. W. Lunar gas chromatography: design problems and solutions, analytical instrumentation, gas chromatograph. In *Proceedings of the IV International Symposium on Gas Chromatography*, Lansing, Michigan, p. 243-259. 1963.

1964

20. BENTLEY, K. E., GIFFIN, C. E., WHITTEN, D. G., and WILHITE, W. F. Detection of life-related compounds on planetary surfaces by gas chromatography-mass spectrometry techniques. In E. R. Van Driest, ed. *Toward Deeper Space Penetration; Proceedings of an AAS Symposium. AAS Science and Technology Series, Vol. 2*, p. 93-117. North Hollywood, Western Periodicals Co., 1964.
21. DEN BOER, J. A., and WILSKA, A. P. Experimental investigations on electrostatic filter lenses with wide image angles. *Commun. Lun. Plan. Lab.* 3(46):1721. June 9, 1964.
22. DEN BOER, J. A., and WILSKA, A. P. Numerical calculations on a wide angle filter lens. *Commun. Lun. Plan. Lab.* 3(47):23-26. June 9, 1964.
23. GEIGER, P. J., MORELLI, F. A., and CONROW, H. Effects of ultra-high vacuum on three types of microorganisms. *Calif. Inst. Tech. Jet Propulsion Lab. Space Progr. Sum.* 37-27, Vol. 4, p. 109-115. 1964.

24. HOBBS, G. L. The gas chromatograph. In F. H. Quimby, ed. Concepts for Detection of Extraterrestrial Life, p. 17-20. 1964. (NASA SP-56)
25. RHO, J. Fluorometric measurements of growth. III. The interference of soil with the fluorescence of proteins in a neutral aqueous solution. Calif. Inst. Tech. Jet Propulsion Lab. Space Progr. Sum. 37-27, Vol. 4, p. 116-126. 1964.
26. WILHITE, W. F. A gas chromatograph for analysis of the Martian atmosphere. Calif. Inst. Tech. Jet Propulsion Lab. Space Progr. Sum. 37-29, Vol. 4, p. 185-188. 1964.

1965

27. BAUMAN, A. J. Urinary 'free' corticosteroids by a simple clinical method, some comments. Calif. Inst. Tech. Jet Propulsion Lab. Space Progr. Sum. 37-33, Vol. 4, p. 202-203. 1965.
28. CAMERON, R. E., and BLANK, G. B. Soil studies - desert microflora. VII. Abundance of chemical elements in an area of soil at White Mountain Range, California. Calif. Inst. Tech. Jet Propulsion Lab. Space Progr. Sum. 37-33, Vol. 4, p. 203-208. 1965.
29. CAMERON, R. E., and BLANK, G. B. Soil studies - desert microflora. VIII. Distribution and abundance of desert microflora. Calif. Inst. Tech. Jet Propulsion Lab. Space Progr. Sum. 37-34, Vol. 4, p. 193-202. 1965.
30. CAMERON, R. E., BLANK, G. B., MORELLI, F. A., and HOBBS, G. L. Soil studies - desert microflora. V. Soil CO<sub>2</sub> production measured by gas chromatography. Calif. Inst. Tech. Jet Propulsion Lab. Space Progr. Sum. 37-32, Vol. 4, p. 209-211. 1965.
31. CAMERON, R. E., MORELLI, F. A., and BLANK, G. B. Soil studies - microflora of desert regions. IV. Soil extract as a culture medium. Calif. Inst. Tech. Jet Propulsion Lab. Space Progr. Sum. 37-32, Vol. 4, p. 202. 1965.
32. CAMERON, R. E., MORELLI, F. A., and BLANK, G. B. Soil studies - desert microflora. VI. Abundance of microflora in an area of soil at White Mountain Range, California. Calif. Inst. Tech. Jet Propulsion Lab. Space Progr. Sum. 37-32, Vol. 4, p. 212-214. 1965.
33. GEIGER, P. J. Rapid estimation of urinary calcium. Calif. Inst. Tech. Jet Propulsion Lab. Space Progr. Sum. 37-31, Vol. 4, p. 221-223. 1965.
34. GEIGER, P. J., JAFFEE, S., and MAMIKUNIAN, G. Biological contamination of the planets. In G. Mamikunian and M. Briggs, eds. Current Aspects of Exobiology, p. 283-322. New York, Pergamon Press, 1965.

35. HOBBY, G. L. Life detection experiments. In G. Mamikunian and M. Briggs, eds. Current Aspects of Exobiology, p. 261-282. New York, Pergamon Press, 1965.
36. MAMIKUNIAN, G., and BRIGGS, M. Trends and problems in exobiology. In G. Mamikunian and M. Briggs, eds. Current Aspects of Exobiology, p. 374-388. New York, Pergamon Press, 1965.
37. MORELLI, F., CAMERON, R. E., and BLANK, G. B. Soil studies - microflora of desert regions. III. Microorganisms in Valley of 10,000 Smokes Desert. Calif. Inst. Tech. Jet Propulsion Lab. Space Progr. Sum. 37-32, Vol. 4, p. 196-202. 1965.
38. RHO, J., THOMPSON, J. R., and BEHAR, J. Fluorometric determination of urea. I. Determination of urea with diacetylmonoxime. Calif. Inst. Tech. Jet Propulsion Lab. Space Progr. Sum. 37-32, Vol. 4, p. 214-215. 1965.
39. RHO, J., THOMPSON, J. R., and BEHAR, J. Fluorometric analysis of urea. II. Determination of urea in urine samples. Calif. Inst. Tech. Jet Propulsion Lab. Space Progr. Sum. 37-32, Vol. 4, p. 216-218. 1965.
40. SOFFEN, G. A. Atmospheric collection at 130,000 feet. In H. M. Tsuchiya and A. H. Brown, eds. Proceedings of the Atmospheric Biology Conference, University of Minnesota, Apr. 13-15, 1964, p. 213-219. Minneapolis, University of Minnesota, 1965.
41. WHITTEN, D. G. A gas chromatograph-mass spectrometer system for space exploration. In L. Fowler et al, eds. Analysis Instrumentation, Proceedings. 11th Symposium, Instrument Society of America. New York, Plenum Press, 1965.

PRINCIPAL INVESTIGATOR KAPLAN, DR. I. R.  
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CONTRACT/GRANT NUMBER: NGR 05-007-077

CONTRACT/GRANT TITLE: Investigation of Techniques for Analysis  
of Ancient Sediments and Extraterrestrial  
Materials

1963

1. KAPLAN, I. R., DEGENS, E. T., and REUTER, J. H. Organic compounds in stony meteorites. Geochim. Cosmochim. Acta 27:805-834. 1963.

1966

2. KAPLAN, I. R., and HULSTON, J. R. The isotopic abundance and content of sulfur in meteorites. Geochim. Cosmochim. Acta 30:479-496. 1966.



PRINCIPAL INVESTIGATOR KAPLAN, DR. N. O.  
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CONTRACT/GRANT NUMBER: NsG-375

CONTRACT/GRANT TITLE: Effects of Environment and Evolution  
on Macromolecules

1963

1. MARMUR, J., FALKOW, S., and MANDEL, M. New approaches to bacterial taxonomy. *Ann. Rev. Microbiol.* 17:328. 1963.
2. MARMUR, J., and GREENSPAN, C. M. Transcription in vivo of DNA from bacteriophage SP8. *Science* 142:387. 1963.
3. MARMUR, J., GREENSPAN, C. M., PALECEK, E., KAHAN, F. M., LEVINE, J., and MANDEL, M. Specificity of the complementary RNA formed by Bacillus subtilis infected with bacteriophage SP8. Cold Spring Harbor Symposia Quant. Biol. 28:191. 1963.
4. MARMUR, J., KAHAN, F. M., RIDDLE, B., and MANDEL, M. Formation of complementary RNA and enzymes in Bacillus subtilis infected with bacteriophage SP8. *In* Instituto Lombardo, Accad. Sci. Lett. Acidi Nucleici e Loro Funzione Biologica - Convegno A. Baselli, Milano, 16-18 Settembre, 1963. Pavia, Fusi, 1964. p. 249.

1964

5. ALLISON, W. S., and KAPLAN, N. O. The comparative enzymology of triosephosphate dehydrogenase. *J. Biol. Chem.* 239:2140. 1964.
6. ALLISON, W. S., and KAPLAN, N. O. Effect of tetrathionate on the stability and immunological properties of muscle triosephosphate dehydrogenases. *Biochemistry* 3:1792. 1964.
7. KAPLAN, N. O. Lactate dehydrogenase-structure and function. *Brookhaven Symp. Biol.* 17:131. 1964.
8. PESCE, A., MCKAY, R., STOLZENBACH, F., CAHN, R., and KAPLAN, N. O. The comparative enzymology of lactic dehydrogenases. I. Properties of the crystalline beef and chicken enzymes. *J. Biol. Chem.* 239: 1753. 1964.
9. REICHLIN, M., HAY, M., and LEVINE, L. Antibodies to human A1 hemoglobin and their reaction with A2, S, C and H hemoglobins. *Immunochemistry* 1:21. 1964.
10. SEAMAN, E., TARMY, E., and MARMUR, J. Inducible phages of Bacillus subtilis. *Biochemistry* 3:607. 1964.

11. WILSON, A. C., KAPLAN, N. O., LEVINE, L., PESCE, A., REICHLIN, M., and ALLISON, W. S. Evolution of lactic dehydrogenases. Fed. Proc. 23:1258. 1964.

1965

12. FONDY, T. P., EVERSE, J., DRISCOLL, G. A., CASTILLO, F., STOLZENBACH, F., and KAPLAN, N. O. The comparative enzymology of lactic dehydrogenases. IV. Function of sulfhydryl groups in lactic dehydrogenases and the sequence around the essential group. J. Biol. Chem. 240(11):4219-4234. Nov. 1965.
13. FONDY, T. P., and KAPLAN, N. O. Structural and functional properties of the H and M subunits of lactic dehydrogenases. Ann. N. Y. Acad. Sci. 119:888. 1965.
14. KAPLAN, N. O. Evolution of dehydrogenases. In B. Bryson and H. J. Vogel, eds. Evolving Genes and Proteins, p. 243. New York, Academic Press, 1965.
15. REICHLIN, M., HAY, M., and LEVINE, L. Immunochemical studies on inter-species molecular hybrids of hemoglobin. Immunochemistry 2:337. 1965.
16. SALTHER, S. N., CHILSON, O. P., and KAPLAN, N. O. Hybridization of lactic dehydrogenases in vivo and in vitro. Nature 207:723-726. 1965.

1966

17. GOODFRIEND, T. L., SOKIL, D., and KAPLAN, N. O. Control of synthesis of lactic acid dehydrogenases. J. Mol. Biol. 15:18. 1966.
18. KITTO, G. B., WASSERMAN, P. M., MICHEJDA, J., and KAPLAN, N. O. Multiple forms of mitochondrial malate dehydrogenases. Biochem. Biophys. Res. Commun. 22:75. 1966.
19. SALTHER, S. N., and KAPLAN, N. O. Immunology and rates of enzyme evolution in the amphibia in relation to the organs of certain taxa. Evolution 20(4):603-616. Dec. 1966. 37 Refs.

PRINCIPAL INVESTIGATOR KAY, DR. R. E.  
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CONTRACT/GRANT NUMBER: NASw-770 (terminated)

CONTRACT/GRANT TITLE: Determine the Feasibility of Detecting  
Protein by means of "J" Band Formation -  
A Color Change Produced by Intense  
Absorption of Light in the Visibility  
Spectrum when certain Dyes React with  
Protein

1964

1. KAY, R. E., WALWICK, E. R., and GIFFORD, C. K. Spectral changes in a cationic dye due to interaction with macromolecules. I. Behavior of dye alone in solution and the effect of added macromolecules. J. Phys. Chem. 68:1896. 1964.
2. KAY, R. E., WALWICK, E. R., and GIFFORD, C. K. Spectral changes in a cationic dye due to interaction with macromolecules. II. Effects of environment and macromolecule structure. J. Phys. Chem. 68:1907. 1964.

1965

3. BEAN, R. C., SHEPHERD, W. C., KAY, R. E., and WALWICK, E. R. Spectral changes in a cationic dye due to interaction with macromolecules. III. Stoichiometry and mechanism of the complexing reaction. J. Phys. Chem. 69(12):4368-4379. Dec. 1965.

PRINCIPAL INVESTIGATOR LEDERBERG, DR. J.  
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CONTRACT/GRANT NUMBER: NsG-81

CONTRACT/GRANT TITLE: Cytochemical Studies of Planetary  
Microorganisms

1962

1. LEDERBERG, J., and SAGAN, C. Microenvironments for life on Mars.  
Proc. Nat. Acad. Sci. U. S. 48(9):1473-1475. 1962.

1964

2. AIR FORCE Final Report/NASA Technical report-video tracking systems.  
Stanford University School of Medicine, Palo Alto, California,  
Instrum. Res. Lab. No. 1014. Nov. 1, 1964. 30 p.
3. GIBBONS, J. F., and HORN, H. S. A circuit with logarithmic transfer  
response over nine decades. IEEE Trans. CT-11:378-384. Sept. 1964.
4. LEDERBERG, J. Computation of molecular formulas for mass spectrometry.  
San Francisco, Holden-Day, Inc., 1964. 69 p.
5. LEDERBERG, J. DENDRAL-64. A system for computer construction,  
enumeration and notation of organic molecules as tree structures and  
cyclic graphs. Part I. Stanford University School of Medicine,  
Palo Alto, California, Instrum. Res. Lab. No. 1036. 1964.
6. LEDERBERG, J. Tables and an algorithm for calculating functional  
groups of organic molecules in high resolution in mass spectrometry.  
Stanford University School of Medicine, Palo Alto, California,  
Instrum. Res. Lab. No. 1019. 1964.
7. LEDERBERG, J., and WRIGHTMAN, M. Calculation of upper limit of hydro-  
gens of an organic formula for analysis of mass spectra. Anal. Chem.  
36:2365. 1964.
8. LEDERBERG, J., and WRIGHTMAN, M. A subalgol program for calculation of  
molecular compositional formulas from mass spectral data. Stanford  
University School of Medicine, Palo Alto, California, Instrum. Res.  
Lab. No. 1037. 1964.
9. LEVINTHAL, E. C., LEDERBERG, J., and HUNDLEY, L. Multivator - a  
biochemical laboratory for Martian experiments. In M. Florkin and  
A. Dollfus, eds. Life Sciences and Space Research, II, p. 112-123.  
Amsterdam, North-Holland Publ. Co., 1964.

10. LUENBERG, D. G. Resolution of mass spectrometer data. Stanford University School of Medicine, Palo Alto, California, Instrum. Res. Lab. No. 1021. Nov. 1964. 39 p.
11. MANDEL, M. Effect of temperature on the proton magnetic resonance spectra of ribonuclease, oxidized ribonuclease, and lysozyme. Proc. Nat. Acad. Sci. U. S. 52(3):736-741. 1964.
12. MANDEL, M., and WESTLEY, J. W. Nuclear magnetic resonance of phosphorus in deoxythymidine polynucleotides. Nature 203:301. 1964.
13. WESTLEY, J. W. Fluorescein and naphthol substrates for phosphatase assays. Stanford University School of Medicine, Palo Alto, California, Instrum. Res. Lab. No. 1010. July 1, 1964.

1965

14. APLIN, R. T., BUDZIKIEWICZ, H., and DJERASSI, C. Mass spectrometry in structural stereo-chemical problems. LXXIII. The negative ion mass spectra of some simple organic compounds. J. Amer. Chem. Soc. 87: 3180. 1965.
15. APLIN, R. T., BUDZIKIEWICZ, H., HORN, H. S., and LEDERBERG, J. Logarithmic recording of mass spectra, especially peaks from metastable ions. Anal. Chem. 37:776. 1965.
16. BUDZIKIEWICZ, H., GRAUMAN, J. I., and DJERASSI, C. Mass spectrometry in structural and stereochemical problems. LXVII. Retro-Diels-Alder reaction of organic molecules under electron impact. Tetrahedron 21: 1855. 1965.
17. DJERASSI, C., and FENSELAU, C. Mass spectrometry in structural and stereo-chemical problems. LXXXIV. The nature of the cyclic transition state in hydrogen rearrangements of aliphatic amines. J. Amer. Chem. Soc. 87:5747. 1965.
18. DJERASSI, C., and FENSELAU, C. Mass spectrometry in structural and stereo-chemical problems. LXXXV. The nature of the cyclic transition state in hydrogen rearrangements of aliphatic amines. J. Amer. Chem. Soc. 87:5752. 1965.
19. DJERASSI, C., and SAMPLE, S. D. Mass spectrometry in structural and stereo-chemical problems. LXXX. Mass spectrometric fragmentation of nitrophenylhydrazones. Nature 308:1314. 1965.
20. DJERASSI, C., SHAPIRO, R. H., and VANDEWALLE, M. Mass spectrometry in structural and stereo-chemical problems. LXXXI. Stereospecificity in hydrogen transfer reaction characteristic of 6-Keto steroids. J. Amer. Chem. Soc. 87:4892. 1965.
21. DUFFIELD, A. M., BUDZIKIEWICZ, H., and DJERASSI, C. Mass spectrometry in structural and stereo-chemical problems. LXX. A study of the fragmentation processes of some five membered N-alkyl lactams and N-alkyl succinimides. J. Amer. Chem. Soc. 87:2913. 1965.

22. DUFFIELD, A. M., BUDZIKIEWICZ, H., and DJERASSI, C. Mass spectrometry in structural and stereo-chemical problems. LXXI. A study of the influence of different heteroatoms on the mass spectrometric fragmentation of five-membered heterocycles. J. Amer. Chem. Soc. 87:2920. 1965.
23. HALPERN, B., and WESTLEY, J. W. High sensitivity optical resolution of D, L amino acids by gas chromatography. Biochem. Biophys. Res. Comm. 19(3):361. 1965.
24. HALPERN, B., and WESTLEY, J. W. Resolution of neutral D, L, amino acids via their L, menthyl ester derivatives. Chem. Comm. 18:247. 1965.
25. HALPERN, B., WESTLEY, J. W., VON WREDENHAGEN, I., and LEDERBERG, J. Optical resolution of D, L, amino acids by gas liquid chromatography and mass spectrometry. Biochem. Biophys. Res. Comm. 20(6):710. 1965.
26. LEDERBERG, J. Pasteur probe. Stanford University School of Medicine, Palo Alto, California, Instrum. Res. Lab. No. 1016. Mar. 10, 1965.
27. LEDERBERG, J. Signs of life. Nature 207:9-13. 1965.
28. LEDERBERG, J. Topological mapping of organic molecules. Proc. Nat. Acad. Sci. U. S. 53:134-139. 1965.
29. LEDERBERG, J., and HUNDLEY, L. Linc evaluation program. Final Report. Stanford University School of Medicine, Palo Alto, California, Instrum. Res. Lab. No. 1023. Mar. 1965.
30. LUNDSTROM, J. Membrane separation. Stanford University School of Medicine, Palo Alto, California, Instrum. Res. Lab. No. 1012. Oct. 6, 1965.
31. LUNDSTROM, J. A theory for molecular transport phenomena through thin membranes. Stanford University School of Medicine, Palo Alto, California, Instrum. Res. Lab. No. 1034. May 1965. 79 p. 10 Refs.
32. MANDEL, M. Proton magnetic resonance spectra of some proteins. I. Ribonuclease, oxidized ribonuclease, lysozyme, and cytochrome. J. Biol. Chem. 240:1586-1592. 1965.
33. MARTIN, N. An investigation of the mass spectra of twenty-two free amino acids. Stanford University School of Medicine, Palo Alto, California, Instrum. Res. Lab. No. 1035. Sept. 21, 1965. 58 p.
34. MOORE, R. K. An operating system for the Linc computer. Stanford University School of Medicine, Palo Alto, California, Instrum. Res. Lab. No. 1038. Nov. 1, 1965.
35. REYNOLDS, W. Logarithmic amplifier. Stanford University School of Medicine, Palo Alto, California, Instrum. Res. Lab. No. 1017. Apr. 1, 1965.
36. SHNEOUR, E. A. 3-methoxy-dihydrofluoran-6-ol-6-phosphate: a fluorogenic substrate for detection of enzymatic activities. Stanford University School of Medicine, Palo Alto, California, Instrum. Res. Lab. No. 1015. May 11, 1965.

37. STEVENS, V. Fluorometric assay for nuclease activity. Stanford University School of Medicine, Palo Alto, California, Instrum. Res. Lab. No. 1029. July 26, 1965.
38. STRYER, L. The interaction of a naphthalene dye with apomyoglobin and apohemoglobin. A fluorescent probe of nonpolar binding sites. J. Mol. Biol. 13(2):482-495. 1965.
39. WALSER, A., and DJERASSI, C. Alkaloid studies LII. The alkaloids of Vallesia dichotoma. Helv. Chim. Acta 48(2):391-404. 1965.

1966

40. HALPERN, B., RICKS, J., and WESTLEY, J. W. Biochemical applications of gas liquid chromatography. I. The stereospecific hydrolytic action of acylase I. (Hog kidney). Anal. Biochem. 14(1):156-159. Jan. 1966.
41. HALPERN, B., RICKS, J., and WESTLEY, J. W. The stereospecificity of  $\alpha$ -chymotrypsin-catalysed reactions. IRL-1042. 1966.
42. HALPERN, B., and WESTLEY, J. W. Chemical resolution of secondary ( $\pm$ ) alcohols. Aust. J. Chem. 19(8):1533-1534. Aug. 1966.
43. HALPERN, B., and WESTLEY, J. W. High sensitivity optical resolution of amines by gas chromatography. Chem. Comm. 2:34. 1966.
44. HALPERN, B., and WESTLEY, J. W. High sensitivity optical resolution of poly-functional amino acids by gas liquid chromatography. Tetrahedron Letters:2283-2286. 1966.
45. HALPERN, B., WESTLEY, J. W., ANDERSON, P. J., and LEDERBERG, J. Demonstration of the stereospecific action of microorganisms in soil by gas liquid chromatography. Anal. Biochem. 17(1):179-181. 1966.
46. SHNEOUR, E. A. Oxidation of graphitic carbon in certain soils. Science 151(3713):991-992. 1966.

PRINCIPAL INVESTIGATOR LIBBY, DR. W.  
AND ADDRESS: University of California  
Institute of Geophysics and Planetary  
Physics  
Los Angeles, California 90024

CONTRACT/GRANT NUMBER: NsG-237

CONTRACT/GRANT TITLE: Coordinated Group for Analysis of Carbon  
Compounds in Carbonaceous Chondrites and  
Returned Lunar Material

1964

1. DAVIS, D. R., and LIBBY, W. F. Positive-ion chemistry: high yields of heavy hydrocarbons from solid methane by ionizing radiation. Science 144(3621):991-992. May 22, 1964.



PRINCIPAL INVESTIGATOR LIPSKY, DR. S. R.  
AND ADDRESS: Yale University  
School of Medicine  
Section of Physical Sciences  
New Haven, Connecticut 06510

CONTRACT/GRANT NUMBER: NsG-192

CONTRACT/GRANT TITLE: Development of Experimental Gas  
Chromatography - Mass Spectrometry  
Techniques

1962

1. SHAHIN, M. M. Reaction of elementary carbon and hydrogen in high-frequency discharge. Nature 195(4845):992-993. Sept. 1962.

1963

2. LIPSKY, S. R., and SHAHIN, M. M. Use of xenon and krypton as carrier gases for a highly sensitive detection system for gas chromatography. Nature 200:566-567. 1963.
3. LIPSKY, S. R., and SHAHIN, M. M. Sensitive ionization system for the detection of permanent gases and organic vapors by gas chromatography. Nature 197:625-626. 1963.
4. SHAHIN, M. M., and LIPSKY, S. R. The mechanisms of operation of a new and highly sensitive ionization system for the detection of permanent gases and organic vapors by gas chromatography. Anal. Chem. 35:467. 1963.
5. SHAHIN, M. M., and LIPSKY, S. R. The role of argon metastable atoms in the ionization of organic molecules. Anal. Chem. 35:1562. 1963.

1964

6. SHAHIN, M. M., and LIPSKY, S. R. Energy transfer between molecules and electronically excited atoms. J. Chem. Phys. 41(7):2021-2026. Oct. 1964.

1965

7. SHAHIN, M. M., and LIPSKY, S. R. II. Energy transfer between molecules and electronically excited atoms. J. Phys. Chem. 69:4406. 1965.

1966

8. LIPSKY, S. R., HORVATH, C. G., and McMURRAY, W. J. Utilization of system employing the selective permeation of helium through a unique membrane of teflon as an interface for gas chromatograph and mass spectrometer. Anal. Chem. 38:1585. Oct. 1966.

9. McMURRAY, W. J., GREEN, B. N., and LIPSKY, S. R. Fast scan high resolution mass spectrometry. Operating parameters and its tandem use with gas chromatography. Anal. Chem. 38(9):1194-1204. Aug. 1966.

PRINCIPAL INVESTIGATOR   LOWE, DR. C.  
AND ADDRESS:               University of Florida  
                              College of Medicine  
                              Department of Pediatrics  
                              Gainesville, Florida 32603

CONTRACT/GRANT NUMBER:   NGR 10-005-062

CONTRACT/GRANT TITLE:    Primitive Earth Synthesis of Amino Acids  
                              and Polypeptides

1962

1. LOWE, C. U., and REES, M. W.   Synthesis of amino acids and polypeptides under possible earth conditions.   Amer. J. Dis. Children 104:504. 1962.

1963

2. LOWE, C. U., REES, M. W., and MARKHAM, R.   Synthesis of complex organic compounds from simple precursors: formation of amino acids, amino acid polymers, fatty acids and purines from ammonium cyanide.   Nature 199:219. 1963.

PRINCIPAL INVESTIGATOR McLAREN, DR. A. D.  
AND ADDRESS: University of California  
Department of Soils and Plant Nutrition  
Berkeley, California 94720

CONTRACT/GRANT NUMBER: NsG-704

CONTRACT/GRANT TITLE: Enzyme Activity in Terrestrial Soil in  
Relation to Exploration of the Martian  
Surface

1965

1. SKUJINS, J. J.  $C^{14}O_2$  detection chamber for studies in soil metabolism. *Biologie du Sol*, N.S., No. 4, p. 14-17. 1965.

1966

2. McLAREN, A. D. The biochemistry of terrestrial soils. In C. S. Pittendrigh, W. Vishniac, and J. P. T. Pearman, eds. *Biology and the Exploration of Mars*, p. 147-163. Washington, D. C., Nat. Acad. Sci. - Nat. Res. Council, 1966.
3. RAMIREZ-MARTINEZ, J. R., and McLAREN, A. D. Determination of soil phosphatase activity by a fluorimetric technique. *Enzymologia* 30: 243-253. 1966.
4. RAMIREZ-MARTINEZ, J. R., and McLAREN, A. D. Some factors influencing the determination of phosphatase activity in native soils and in soils sterilized by irradiation. *Enzymologia* 31:23-38. 1966.

PRINCIPAL INVESTIGATOR MEINSCHN, DR. W. G.  
AND ADDRESS: Indiana University  
Department of Geology  
Bloomington, Indiana

CONTRACT/GRANT NUMBER: NASw-508

CONTRACT/GRANT TITLE: Organic Analysis as a means of Defining  
the History of Planetary Crusts

1963

1. MEINSCHN, W. G. Benzene extracts of the Orgueil meteorite. Nature 197:833. 1963.
2. MEINSCHN, W. G. Evidence concerning extraterrestrial life. Ind. Res. p. 20-24. Sept. 1963.
3. MEINSCHN, W. G. Hydrocarbons in terrestrial samples and the Orgueil meteorite. Space Sci. Rev. 2:653-679. 1963.
4. MEINSCHN, W. G., NAGY, B., and HENNESSY, D. J. Evidence in meteorites of former life: the organic compounds in carbonaceous chondrites are similar to those found in marine sediments. Ann. N. Y. Acad. Sci. 108:553-579. 1963.

1964

5. MEINSCHN, W. G., BARGHOORN, E. S., and SCHOPF, J. W. Biological remnants in a Precambrian sediment. Science 145:262. 1964.

1965

6. BARGHOORN, E. S., MEINSCHN, W. G., and SCHOPF, J. W. Paleobiology of a Precambrian shale. Science 148:461. 1965.
7. MEINSCHN, W. G. Carbon compounds in terrestrial samples and the Orgueil meteorite. In M. Florin, ed. Life Sciences and Space Research, III, p. 165-181. Amsterdam, North-Holland Publ. Co., 1965.
8. MEINSCHN, W. G. Organic extracts of early Precambrian rocks from the Soudan formation. Science 150(3696):601-605. Oct. 29, 1965.

PRINCIPAL INVESTIGATOR MOROWITZ, DR. H. J.  
AND ADDRESS: University of Hawaii  
Department of Microbiology  
2538 The Mall  
Honolulu, Hawaii

CONTRACT/GRANT NUMBER: NsG-208

CONTRACT/GRANT TITLE: Studies on Extremely Small Self-Replicating  
Systems

1964

1. SKOULTCHI, A. I., and MOROWITZ, H. J. Information storage and survival of biological systems at temperatures near absolute zero. Yale J. Biol. Med. 37:158-163. 1964.

1965

2. MOROWITZ, H. J. Requirements of a minimum free living replicating system. In M. Florkin, ed. Life Sciences and Space Research, III, p. 149-153. Amsterdam, North-Holland Publ. Co., 1965.
3. RAZIN, S., MOROWITZ, H. J., and TERRY, T. M. Membrane subunits of Mycoplasma laidlawii and their assembly to membranelike structures. Proc. Nat. Acad. Sci. U. S. 54:219-225. 1965.

1966

4. MOROWITZ, H. J., and MANILOFF, J. Analysis of the life cycle of Mycoplasma gallisepticum. J. Bacteriol. 91(4):1638-1644. Apr. 1966. 6 Refs.

PRINCIPAL INVESTIGATOR OPFELL, DR. J. B.  
AND ADDRESS: Dynamic Science Corporation  
South Pasadena, California

CONTRACT/GRANT NUMBER: NASw-777(terminated)

CONTRACT/GRANT TITLE: Prepare a Handbook which includes Complete  
Directions for Effective Techniques of  
Sterilizing Spacecraft Components, Subsystems,  
and Assemblies - Techniques providing for  
Internal Sterilization, Aseptic Assembly and  
Applicability of Clean Room Facilities,  
Terminal Sterilization, and other Methods,  
to include Emergency Provisions; Standard  
Operational Procedures for Determining Levels  
of Contamination; Enumeration of Key Organisms;  
Methods to be used for Sterility Testing;  
Methods for Preserving and Monitoring  
Sterility

1964

1. OPFELL, J. B. A general review of chemical sterilization in space research. In M. Florkin and A. Dollfus, eds. Life Sciences and Space Research, II, p. 385-405. Amsterdam, North-Holland Publ. Co., 1964.
2. OPFELL, J. B., WANG, Y.-L., LOUDERBACK, A. L., and MILLER, C. E. Penetration by gases to sterilize interior surfaces of confined spaces. Appl. Microbiol. 12:27. 1964.

1965

3. OPFELL, J. B., and MILLER, C. E. Cold sterilization techniques. In W. W. Umbreit, ed. Advances in Applied Microbiology, Vol. 7. New York, Academic Press, 1965.

PRINCIPAL INVESTIGATOR ORO, DR. J.  
AND ADDRESS: University of Houston  
Department of Chemistry  
Cullen Boulevard  
Houston, Texas 77004

CONTRACT/GRANT NUMBER: NsG-257

CONTRACT/GRANT TITLE: Studies in Organic Cosmochemistry

1961

1. ORO, J. Mechanism of synthesis of adenine from hydrogen cyanide under possible primitive earth conditions. Nature 191(4794):1193-1194. Sept. 16, 1961.

1963

2. ORO, J. Experimental organic cosmochemistry, formation of biochemical compounds. Proc. 12th Lun. Plan. Expl. Colloq. 3(2):9-27. 1963.
3. ORO, J. Non-enzymic formation of purines and pyrimidines. Fed. Proc. 22:681. 1963.
4. ORO, J. Studies in experimental organic cosmochemistry. Ann. N. Y. Acad. Sci. 109:464. 1963.
5. ORO, J. Synthesis of organic compounds by electric discharges. Nature 197:862. 1963.
6. ORO, J. Synthesis of organic compounds by high energy electrons. Nature 197:971. 1963.
7. ORO, J. Ultraviolet-absorbing compound(s) reported present in the Murray meteorite. Nature 197:756. 1963.

1964

8. NOONER, D. W., and ORO, J. Non-enzymic polypeptide synthesis by means of polyphosphate esters. Sixth International Congress of Biochemistry, New York, 1964. Int. Union Biochem. 32:171. 1964.
9. ORO, J. Prebiological synthesis of nucleic acid constituents. In W. L. Kretoovich, ed. Problems of Evolutionary and Industrial Biochemistry, p. 63-69. Moscow, A. N. Back Institute of Biochemistry, Academy of Sciences, 1964.



1965

10. ORO, J. Investigation of organo-chemical evolution. In G. Mamikunian and M. H. Briggs, eds. Current Aspects of Exobiology, p. 13-76. New York, Pergamon Press, 1965.
11. ORO, J. Stages and mechanisms of prebiological organic synthesis. In S. W. Fox, ed. The Origins of Prebiological Systems and Their Molecular Matrices, p. 137-161. New York, Academic Press, 1965.
12. ORO, J., and NOONER, D. W. Hydrocarbons of biological origin in sediments about two billion years old. Fed. Proc. 24:663. 1965.
13. ORO, J., and NOONER, D. W. Paraffinic hydrocarbons in carbonaceous meteorites. Science 150:380. 1965.
14. ORO, J., NOONER, D. W., and WIKSTROM, S. A. Gas chromatographic-mass spectrometric analysis of paraffinic hydrocarbons in animal products. J. Gas Chromatogr. p. 105. Mar. 1965.
15. ORO, J., NOONER, D. W., and WIKSTROM, S. A. Paraffinic hydrocarbons in pasture plants. Science 147:870. 1965.
16. ORO, J., NOONER, D. W., ZLATKIS, A., WIKSTROM, S. A., and BARGHOORN, E. S. Hydrocarbons of biological origin in sediments about two billion years old. Science 148:77. 1965.
17. ORO, J., and SKEWES, H. B. Free amino acids on human fingers: the question of contamination in microanalysis. Nature 207:1042. 1965.
18. ORO, J., and TORNABENE, T. Bacterial contamination of some carbonaceous meteorites. Science 150(3699):1046-1048. Nov. 19, 1965.

1966

19. ORO, J., BIEMANN, K., GOHLKE, R. S., LIPSKY, S. R., LOVELOCK, J. E., McLAFFERTY, F. W., MEINSCHIEIN, W. G., and RYHAGE, R. Gas chromatography-mass spectrometry. In C. S. Pittendrigh, W. Vishniac, and J. P. T. Pearman, eds. Biology and the Exploration of Mars, p. 378-384. Washington, D. C., Nat. Acad. Sci. - Nat. Res. Council., 1966.
20. ORO, J., LIPSKY, S. R., OYAMA, V. I., SHOEMAKE, G. R., and ZLATKIS, A. Gas chromatography. In C. S. Pittendrigh, W. Vishniac, and J. P. T. Pearman, eds. Biology and the Exploration of Mars, p. 368-375. Washington, D. C., Nat. Acad. Sci. - Nat. Res. Council., 1966.
21. ORO, J., and NOONER, D. W. Hydrocarbons in lipid extracts of algal mats. Fed. Proc. 25:768. 1966.
22. ORO, J., NOONER, D. W., ZLATKIS, A., and WIKSTROM, S. A. Paraffinic hydrocarbons in the Orgueil, Murray, Mokoia and other meteorites. In Life Sciences and Space Research, Vol. 4, p. 63-100. 1966.

PRINCIPAL INVESTIGATOR PIMENTEL, DR. G. C.  
AND ADDRESS: University of California  
Department of Chemistry  
Berkeley, California 94720

CONTRACT/GRANT NUMBER: NASr-212

CONTRACT/GRANT TITLE: Infrared Spectrometer

1965

1. SHIRK, J. S., HASELTINE, W. A., and PIMENTEL, G. C. Sinton band:  
evidence for deuterated water on Mars. Science 147:48-49. 1965.

1966

2. PIMENTEL, G. C., and others. Exotic biochemistries in exobiology.  
In C. S. Pittendrigh, W. Vishniac, and J. P. T. Pearman, eds.  
Biology and the Exploration of Mars, p. 243-251. Washington, D. C.,  
Nat. Acad. Sci. - Nat. Res. Counc., 1966.

PRINCIPAL INVESTIGATOR REA, DR. D.  
AND ADDRESS: University of California  
Space Science Laboratory  
Berkeley, California 94720

CONTRACT/GRANT NUMBER: NASr-220

CONTRACT/GRANT TITLE: Development of a Scanning System for the  
Mariner Spacecraft

1963

1. REA, D. G. Evidence for life on Mars. Nature 200:114-116. 1963.
2. REA, D. G., BELSKY, T., and CALVIN, M. The interpretation of the 3-4 micron infrared spectrum of Mars. Science 141:923-927. 1963.
3. REA, D. G., and WELCH, W. J. The reflection and emission of electron magnetic radiation by planetary surfaces. Space Sci. Rev. 2:558. 1963.

1964

4. REA, D. G. The darkening wave on Mars. Nature 201:1014. 1964.
5. REA, D. G., BELSKY, T., and CALVIN, M. Reflection spectra of bio-organic materials in the 2.5-4 micron region and the interpretation of the infrared spectrum of Mars. In M. Florkin and A. Dollfus, eds. Life Sciences and Space Research, II, p. 86-100. Amsterdam, North-Holland Publ. Co., 1964.
6. REA, D. G., HETHERINGTON, N., and MIFFLIN, R. The analysis of radar echoes from the moon. J. Geophys. Res. 69:5217. 1964.

1965

7. REA, D. G. Some comments on 'The Composition of the Martian Surface' by R. A. Van Tassel and J. S. Salisbury. Icarus 4(1):108-109. Apr. 1965.
8. REA, D. G., O'LEARY, B. T., and SINTON, W. M. Mars: on the origin of the 3.58 and 3.69 micron minima in the infrared spectra. Science 147:1286. 1965.

PRINCIPAL INVESTIGATOR ROSENBERG, DR. E.  
AND ADDRESS: University of California  
Department of Bacteriology  
Los Angeles, California 90024

CONTRACT/GRANT NUMBER: NsG-672

CONTRACT/GRANT TITLE: An Experimental Investigation of the  
Geochemistry of Nucleic Acids

1964

1. MINTON, A., and ROSENBERG, E. The effect of temperature on the preservation of purine and pyrimidine bases. . . Geochim. Cosmochim. Acta 28:1953-1959. 1964.
2. ROSENBERG, E. Purine and pyrimidines in sediments from the experimental Mohole. Science 146:1680-1681. 1964.

1966

3. HUANG, P. C., and ROSENBERG, E. Determination of base composition of DNA via depurination. Anal. Biochem. 16:107. 1966.

PRINCIPAL INVESTIGATOR SAGAN, DR. C.  
AND ADDRESS: Harvard College Observatory  
Cambridge 38, Massachusetts

CONTRACT/GRANT NUMBER: NGR 09-015-023

CONTRACT/GRANT TITLE: Selected Studies in Exobiology, Planetary  
Environments, Problems Related to Origin  
of Life

1960

1. SAGAN, C. Biological contamination of the moon. Proc. Nat. Acad. Sci. U. S. 46:396. 1960.
2. SAGAN, C. Indigenous organic matter on the moon. Proc. Nat. Acad. Sci. U. S. 46:393-396. 1960.

1961

3. SAGAN, C. Organic matter and life in meteorites. Proc. Lun. Plan. Exp. Colloq. 2(4):49. 1961.
4. SAGAN, C. Organic matter and the moon. Nat. Acad. Sci. - Nat. Res. Counc. Publ. 757, 49 p. 1961.
5. SAGAN, C. On the origin and planetary distribution of life. Radiat. Res. 15:174. 1961.
6. SAGAN, C. The planet Venus. Science 133:849. 1961.
7. SAGAN, C., and KELLOGG, W. W. The atmospheres of Mars and Venus. Nat. Acad. Sci. - Nat. Res. Counc. Publ. 944, 151 p. 1961.

1963

8. SAGAN, C. Biological exploration of Mars. Adv. Astronaut. Sci. 15: 571. 1963.
9. SAGAN, C. Direct contact among galactic civilizations by relativistic interstellar spaceflight. Planet. Space Sci. 11:485. 1963.
10. SAGAN, C. Microwave properties of the atmosphere and cloud layer of Venus. In E. C. Jordan, ed. Electromagnetic Theory and Antennas, 2:771. London, Pergamon Press, 1963.
11. SAGAN, C. Prospects for lunar organic matter. Proc. Conf. Lun. Expl. Bull. Va. Polytech. Inst. 56. 1963.

12. SAGAN, C. On the nature of the Jovian Red Spot, "La physique des planetes". In Proceedings of the 11th International Astrophysical Colloquium, Leige, Belgium, July 9-12, 1962. p. 506-515. Leige, Institut d'Astrophysique, 1963.
13. SAGAN, C., and KELLOGG, W. W. The terrestrial planets. In L. Goldberg, ed. Ann. Rev. Astron. Astrophys. 1:235. Palo Alto, California, Annual Reviews, Inc., 1963.
14. SAGAN, C., PACKER, E., and SCHER, S. Biological contamination of Mars: II. Cold and aridity as constraints on the survival of terrestrial microorganisms in simulated Martian environments. Icarus 2:293-316. 1963.

1964

15. SAGAN, C. Evidence relevant to life on Mars. In F. H. Quimby, ed. Concepts for the Detection of Extraterrestrial Life, p. 7. 1964. (NASA SP-56)
16. SAGAN, C. Exobiology: a critical review. In M. Florkin and A. Dollfus, eds. Life Sciences and Space Research, II, p. 35-53. Amsterdam, North-Holland Publ. Co., 1964.
17. SAGAN, C. The quest for life beyond the Earth. Harvard Alumni Bulletin 66:508. 1964.
18. SAGAN, C., SCHER, S., and PACKER, E. Biological contamination of Mars: I. Survival of terrestrial microorganisms in simulated Martian environments. In M. Florkin and A. Dollfus, eds. Life Sciences and Space Research, II, p. 352-356. Amsterdam, North-Holland Publ. Co., 1964.

1965

19. SAGAN, C. Is the early evolution of life related to the development of the Earth's core? Nature 206:448. 1965.
20. SAGAN, C. Primordial ultraviolet synthesis of nucleoside phosphates. In S. W. Fox, ed. The Origins of Prebiological Systems and Their Molecular Matrices, p. 207-219. New York, Academic Press, 1965.
21. SAGAN, C., and COLEMAN, S. Spacecraft sterilization standards and contamination of Mars. Astron. Aeronaut. 3(5):22. 1965.
22. SAGAN, C., HANST, P. L., and YOUNG, A. T. Nitrogen oxides on Mars. Planet. Space Sci. 13:73. 1965.
23. SAGAN, C., PHANEUF, J. P., and IHNAT, M. Total reflection spectrophotometry and thermogravimetric analysis of simulated Martian surface materials. Icarus 4:43. 1965.

24. SAGAN, C., and SWAN, P. R. Martian landing sites for the Voyager mission. J. Spacecraft and Rockets 2:18. 1965.

1966

25. KILSTON, S. D., DRUMMOND, R. R., and SAGAN, C. A search for life on Earth at kilometer resolution. Icarus 5:79-98. Jan. 1966. 14 Refs.
26. POLLACK, J. B., and SAGAN, C. Properties of the clouds of Venus. In H. Brown, et al., eds. Proc. Caltech-JPL Lun. Planet. Conf., p. 155. 1966.
27. POLLACK, J. B., and SAGAN, C. Radioevidence on the structure and composition of the Martian surface. In H. Brown, et al., eds. Proc. Caltech-JPL Lun. Planet. Conf., p. 255. 1966.
28. SAGAN, C. Higher organisms on Mars. In C. S. Pittendrigh, W. Vishniac, and J. P. T. Pearman, eds. Biology and the Exploration of Mars, p. 252-255. Washington, D. C., Nat. Acad. Sci. - Nat. Res. Council., 1966.
29. SAGAN, C. Potential yields of biological relevance from remote observations of Mars. In C. S. Pittendrigh, W. Vishniac, and J. P. T. Pearman, eds. Biology and the Exploration of Mars, p. 264-282. Washington, D. C., Nat. Acad. Sci. - Nat. Res. Council., 1966.
30. SAGAN, C. The solar system as an abode of life. In C. S. Pittendrigh, W. Vishniac, and J. P. T. Pearman, eds. Biology and the Exploration of Mars, p. 73-111. Washington, D. C., Nat. Acad. Sci. - Nat. Res. Council., 1966.
31. SAGAN, C., and others. Remote detection of terrestrial life. In C. S. Pittendrigh, W. Vishniac, and J. P. T. Pearman, eds. Biology and the Exploration of Mars, p. 187-209. Washington, D. C., Nat. Acad. Sci. - Nat. Res. Council., 1966.
32. SAGAN, C., and COLEMAN, S. Decontamination standards for Martian exploration programs. In C. S. Pittendrigh, W. Vishniac, and J. P. T. Pearman, eds. Biology and the Exploration of Mars, p. 470-481. Washington, D. C., Nat. Acad. Sci. - Nat. Res. Council., 1966.
33. SAGAN, C., and HAUGHEY, J. W. Launch opportunities and seasonal activity on Mars. In C. S. Pittendrigh, W. Vishniac, and J. P. T. Pearman, eds. Biology and the Exploration of Mars, p. 283-291. Washington, D. C., Nat. Acad. Sci. - Nat. Res. Council., 1966.

1967

34. SAGAN, C. Life on other planets. In S. K. Runcorn and H. C. Urey, eds. International Dictionary of Geophysics. London, Pergamon Press, 1967.

35. SAGAN, C. Origins of the atmospheres of the Earth and planets. In  
S. K. Runcorn and H. C. Urey, eds. International Dictionary of  
Geophysics, p. 2049-2063. London, Pergamon Press, 1967.



PRINCIPAL INVESTIGATOR STRICKLER, DR. A.  
AND ADDRESS: Beckman Instruments, Incorporated  
2500 Harbor Boulevard  
Fullerton, California 92634

CONTRACT/GRANT NUMBER: NAS2-2554

CONTRACT/GRANT TITLE: Detection of Extraterrestrial  
Microorganisms by Microcalorimetry

1966

1. BECKMAN INSTRUMENTS, INC. Detection of extraterrestrial micro-organisms by microcalorimetry. Final Report - FR-2425-101. Scientific and Process Instruments Division, Fullerton, California. Sept. 1966.

PRINCIPAL INVESTIGATOR SUTRO, MR. L.  
AND ADDRESS: Massachusetts Institute of Technology  
Instrumentation Laboratory  
224 Albany Street  
Cambridge, Massachusetts 02139

CONTRACT/GRANT NUMBER: NGR 22-009-138

CONTRACT/GRANT TITLE: Automatic Object Recognition for  
Extraterrestrial Life

1965

1. MORENO-DIAZ, R. An analytical model of the group 2 ganglion cell in the frog's retina. Mass. Inst. Tech. Instrumentation Lab. Rept. No. E-1858. Oct. 1965. 32 p. 13 Refs.

1966

2. SUTRO, L. Information processing and data compression for Exobiology missions. Mass. Inst. Tech., Instrumentation Lab., Cambridge, Mass., Rept. No. R-545, Rev. June 1966. 32 p.
3. SUTRO, L. L., KILMER, W. L., and SIGWART, C. D. 1964 to Sept. 1965 Advanced sensor and control systems. Mass. Inst. Tech. Instrumentation Lab., Cambridge, Mass., Rept. No. R-519. Jan. 1966. 90 p.

PRINCIPAL INVESTIGATOR SWAIN, DR. F. M.  
AND ADDRESS: University of Minnesota  
Minneapolis, Minnesota

CONTRACT/GRANT NUMBER: NGR 24-005-054

CONTRACT/GRANT TITLE: Biochemical Evolution of Pre-Mesozoic  
Carbohydrates

1966

1. SWAIN, F. M., and ROGERS, M. A. Stratigraphic distribution of carbohydrate residues in Middle Devonian Onondaga Beds of Pennsylvania and western New York. Geochim. Cosmochim. Acta 30: 497-509. 1966.

1967

2. SWAIN, F. M., ROGERS, M. A., EVANS, R. D., and WOLFE, R. W. Distribution of carbohydrate residues in some fossil specimens and associated sedimentary matrix and other geologic samples. J. Sediment. Petrol. 37(1):12-24. Mar. 1967. 43 Refs.

PRINCIPAL INVESTIGATOR SZUTKA, DR. A.  
AND ADDRESS: University of Detroit  
Department of Chemistry  
4001 West McNichols Road  
Detroit 21, Michigan

CONTRACT/GRANT NUMBER: NsG-226

CONTRACT/GRANT TITLE: Synthesis of Porphine-Like Substances  
from Simple Precursors

1963

1. SZUTKA, A. Synthesis of porphine-like substances during chemical evolution. Radiat. Res. 19:183. 1963.

1964

2. SZUTKA, A. Porphine-like substances: probable synthesis during chemical evolution. Nature (London) 202:1231. 1964.

1965

3. BALEK, R. W., and SZUTKA, A. Quantitative separation of tetraphenylporphine by thin-layer chromatography. J. Chromatogr. 17:127. 1965.
4. SZUTKA, A. Probable synthesis of porphine-like substances during chemical evolution. In S. W. Fox, ed. The Origins of Prebiological Systems and Their Molecular Matrices, p. 243-254. New York, Academic Press, 1965.
5. SZUTKA, A., and RADZILOWSKI, R. H. Porphine-like substances: III. Synthesis by electrical discharges. Z. Naturforsch. 206:624. 1965.

1966

6. SZUTKA, A. Porphine-like substances: IV. Formation of pyrrolic compounds by ultraviolet irradiation of  $\alpha$ -aminolevulinic acid. Nature (London): 212-401. 1966.

PRINCIPAL INVESTIGATOR UREY, DR. H. C.  
AND ADDRESS: University of California  
Revelle College  
Department of Chemistry  
P.O. Box 109  
La Jolla, California 92038

CONTRACT/GRANT NUMBER: NsG-541

CONTRACT/GRANT TITLE: Analysis of Organic and Inorganic  
Constituents of Carbonaceous and other  
Selected Stony Meteorites

1963

1. CLAUS, G., NAGY, B., and EUROPA, D. L. Further observations on the properties of "organized elements" in carbonaceous chondrites. Ann. N. Y. Acad. Sci. 108:580. 1963.
2. NAGY, B., FREDRIKSSON, K., KUDYNOWSKI, J., and CARLSON, L. Ultraviolet spectra of organized elements. Nature 200:565-566. 1963.
3. NAGY, B., FREDRIKSSON, K., UREY, H. C., CLAUS, G., ANDERSEN, C. A., and PERCY, J. Electron probe microanalysis of organized elements in the Orgueil meteorite. Nature 198:121. 1963.

1964

4. NAGY, B., and ANDERSEN, C. A. Electron probe microanalysis of some carbonate, sulfate and phosphate minerals in the Orgueil meteorite. Amer. Mineral. 49:1730. 1964.
5. NAGY, B., and CLAUS, G. Mineralized micro-structures in carbonaceous meteorites. In U. Colombo and G. D. Hobson, eds. Advances in Organic Geochemistry, p. 109. New York, Pergamon Press, 1964.
6. NAGY, B., and CLAUS, G. Notes on the petrography of the Orgueil meteorite. In U. Colombo and G. D. Hobson, eds. Advances in Organic Geochemistry, p. 115. New York, Pergamon Press, 1964.
7. NAGY, B., MURPHY, M. T. J., MODZELESKI, V. E., ROUSER, G., CLAUS, G., HENNESSY, D. J., COLOMBO, U., and GAZZARRINI, F. Optical activity in the saponified organic matter isolated from the interior of the Orgueil meteorite. Nature 202:228. 1964.
8. NAGY, B., and UREY, H. C. A symposium on microanalysis and carbonaceous meteorites. Bioscience 14:59. 1964.

1965

9. MURPHY, M. T. J., NAGY, B., ROUSER, G., and KRITCHEVSKY, G. Identification of elementary sulfur and sulfur compounds in lipid extracts by thin-layer chromatography. J. Amer. Oil Chem. Soc. 42:475. 1965.
10. NAGY, B., MODZELESKI, V., and MURPHY, M. T. J. Hydrocarbons in the banana leaf, Musa sapientum. Phytochemistry 4:945-950. 1965.

1966

11. BETZ, M. C. V., and NAGY, B. Ozonolysis of "polymer-type" material in coal, kerogen and in the Orgueil meteorite: a preliminary report. Proc. Nat. Acad. Sci. 56:1383-1390. 1966.
12. GAZZARRINI, F., and NAGY, B. Saturated hydrocarbons in human femoral arterial tissues and plaques. Arch. Biochem. Biophys. 113(1): 245-252. 1966.
13. MURPHY, M. T. J., and NAGY, B. Analysis for sulfur compounds in lipid extracts from the Orgueil meteorite. J. Amer. Oil Chem. Soc. 43(4):189-196. 1966.
14. NAGY, B. Investigations of the Orgueil carbonaceous meteorite. Geol. Foren. Stockholm Forhandl. 88:235-272. 1966.
15. NAGY, B. A study of the optical rotation of lipids extracted from soils, sediments, and the Orgueil carbonaceous meteorite. Proc. Nat. Acad. Sci. 56(2):389-398. 1966.
16. UREY, H. C. Biological material in meteorites: a review. Science 151(3707):157-166. Jan. 14, 1966.

PRINCIPAL INVESTIGATOR VISHNIAC, DR. W.  
AND ADDRESS: University of Rochester  
Rochester, New York

CONTRACT/GRANT NUMBER: NsG-209

CONTRACT/GRANT TITLE: Microbiological Studies of Planetary  
Soils

1960

1. VISHNIAC, W. Extraterrestrial microbiology. *Aerosp. Med.* 31:678-680. 1960.

1964

2. WESTON, C. R. Mars - a biological quest. *Rochester Review*: 15-17. Dec. 1964/Jan. 1965.
3. WESTON, C. R. Principles of optical measurements applied to biological growth in the Wolf Trap. In G. J. D. Schock, ed. *Proceedings of the First Annual Rocky Mountain Bioengineering Symposium*, U. S. Air Force Academy, Colorado Springs, Colo., May 4, 5, 1964. p. 99-109. Colorado Springs, U. S. Air Force Academy, 1964.

1965

4. VISHNIAC, W. Bacterial ecologies in limonite. In M. Florkin, ed. *Life Sciences and Space Research, III*, p. 139-141. Amsterdam, North-Holland Publ. Co., 1965.
5. WESTON, C. R. A strategy for Mars. *Amer. Sci.* 53:495-507. Dec. 1965.

1966

6. VISHNIAC, W. Techniques of teleanalysis. In A. H. Brown and M. Florkin, eds. *Life Sciences and Space Research, IV*, p. 101-110. Washington, D. C., Spartan Books, 1966.
7. VISHNIAC, W., and others. A model of Martian ecology. In C. S. Pittendrigh, W. Vishniac, and J. P. T. Pearman, eds. *Biology and the Exploration of Mars*, p. 229-242. Washington, D. C., Nat. Acad. Sci. - Nat. Res. Council., 1966.

PRINCIPAL INVESTIGATOR WHIPPLE, DR. F.  
AND ADDRESS: Smithsonian Astrophysical Observatory  
Cambridge, Massachusetts 02138

CONTRACT/GRANT NUMBER: NsG-291

CONTRACT/GRANT TITLE: Systematic In-Flight Photography and  
Subsequent Recovery of Meteorites

1965

1. McCROSKY, R. E., and BOESCHENSTEIN, H., JR. The Prairie Meteorite Network. Research in Space Science, SR-173. Cambridge, Massachusetts, Smithsonian Institution Astrophysical Observatory, May 24, 1965. 23 p.



PRINCIPAL INVESTIGATOR WOLKEN, DR. J. J.  
AND ADDRESS: Carnegie Institute of Technology  
Biophysical Research Laboratory  
Schenley Park  
Pittsburgh, Pennsylvania 15213

CONTRACT/GRANT NUMBER: NGR 39-002-011

CONTRACT/GRANT TITLE: Development of New Microspectrophotometric  
Instrumentation

1959

1. STROTHER, G. K., and WOLKEN, J. J. A simplified microspectrophotometer. Science 130:1084-1088. 1959.

1960

2. STROTHER, G. K., and WOLKEN, J. J. Microspectrophotometry. I. Absorption spectra of colored oil globules in the chicken retina. Exp. Cell Res. 21:504-512. 1960.
3. STROTHER, G. K., and WOLKEN, J. J. Microspectrophotometry of Euglena chloroplast and eyespot. Nature 188:601-602. 1960.

1961

4. STROTHER, G. K., and WOLKEN, J. J. In vivo absorption spectra of Euglena: chloroplast and eyespot. J. Protozool. 8:261-265. 1961.
5. WOLKEN, J. J. Euglena: an experimental organism for biochemical and biophysical studies. New Brunswick, New Jersey, Institute of Microbiology, Rutgers, the State University, 1961. 173 p.

1962

6. WELLS, C. L., and WOLKEN, J. J. Microspectrophotometry of haemosiderin granules. Nature 193:977-978. 1962.

1963

7. WOLKEN, J. J., and STROTHER, G. K. Microspectrophotometry. Appl. Opt. 2:899-907. 1963.

1965

8. WOLKEN, J. J. Molecular and fine structure of photoreceptors. In E. J. Bowen, ed. Recent Progress in Photobiology, p. 145-151. London, Academic Press, 1965.
9. WOLKEN, J. J. The new biology. Carnegie Magazine 39:261. 1965.

10. WOLKEN, J. J. Vision: biochemistry and biophysics of the retina. Springfield, Illinois, Charles C. Thomas, 1965.

1966

11. WOLKEN, J. J. Microspectrophotometry. In G. L. Clark, ed. Encyclopedia of Chemistry. New York, Reinhold Publ. Co., 1966.
12. WOLKEN, J. J. Vision: biophysics and biochemistry of retinal photoreceptors. Springfield, Illinois, Charles C. Thomas, 1966.

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C. W. Shilling, M.D.  
Director

## PREFACE

This report lists publications resulting from research supported, at least in part, by the Physical Biology Branch of the National Aeronautics and Space Administration's Bioscience Programs Division. A few publications may predate the establishment of this office but are included because they resulted from efforts which were subsequently subsumed under this program branch. Each project, indexed alphabetically according to principle investigator, reveals the published activity of each contractual endeavor. All of the 137 citations contained herein were provided in answer to a letter requesting such information from the principle investigator of the various grants and contracts monitored by this office.

Research programs involving large expenditures of both effort and funding must be subjected to periodic evaluation in order to identify the current state of the art for the respective field and to reveal the direction that such organized activities are taking. By this means, areas of critical need are recognized and remedied, and areas of increasingly limited interest are given appropriate attention. There are various methods for evaluating such programs only one of which is by the quantity of publications ensuing from a given activity or group of related activities. While in itself it is an inaccurate means for appraising either effort or accomplishment, combined with other factors it provides a useful measuring device. Submission of this report is made to provide some assistance in the constructive appraisal of the National Aeronautics and Space Administration's research activities in the field of physical science.

Leslie A. Kulp, Ph.D.  
Senior Research Scientist

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PRINCIPAL INVESTIGATOR ARMSTRONG, G. T.  
AND ADDRESS: U. S. Department of Commerce  
National Bureau of Standards  
Washington, D. C. 20234

CONTRACT NUMBER: R-138

CONTRACT TITLE: Thermodynamic Properties of Molecular  
Complexes

1964

1. ARMSTRONG, G. T., DOMALSKI, E. S., FURUKAWA, G. T., and KRIVANEC, M. A.  
A survey of thermodynamic properties of the compounds of the  
elements CHNOPS. Nat. Bur. Standards Rept. No. 8595. Nov. 1,  
1964. 30 p.
2. ARMSTRONG, G. T., FURUKAWA, G. T., and HILSENATH, J. A survey of  
thermodynamic properties of the compounds of the elements CHNOPS.  
Nat. Bur. Standards Rept. No. 8521. Aug. 1, 1964. 52 p.

1965

3. ARMSTRONG, G. T., DOMALSKI, E. S., INSCOE, M. N., HALOW, I., FURUKAWA,  
G. T., and BURESH, M. K. A survey of thermodynamic properties  
of the compounds of the elements CHNOPS. Nat. Bur. Standards  
Rept. No. 8906. July 1, 1965. 86 p.
4. ARMSTRONG, G. T., DOMALSKI, E. S., INSCOE, M. N., HALOW, I., FURUKAWA,  
G. T., and KRIVANEC, M. A. A survey of thermodynamic properties  
of the compounds of the elements CHNOPS. Nat. Bur. Standards  
Rept. No. 8641. Feb. 1, 1965. 33 p.
5. BURESH, M. K., REILLY, M. L., FURUKAWA, G. T., and ARMSTRONG, G. T.  
A survey of thermodynamic properties of the compounds of the elements  
CHNOPS. Nat. Bur. Standards Rept. No. 8992. Oct. 1, 1965.  
26 p.

PRINCIPAL INVESTIGATOR BENZINGER, DR. T.  
AND ADDRESS: Naval Medical Research Institute  
National Naval Medical Center  
Bethesda, Maryland 20014

CONTRACT NUMBER: R-38

CONTRACT TITLE: Molecular Energetics

1961

1. BENZINGER, T. H. The diminution of thermoregulatory sweating during cold-reception at the skin. Proc. Nat. Acad. Sci. 47:1683. 1961.
2. BENZINGER, T. H. The human thermostat. Sci. Amer. 204(1):134-147. Jan. 1961.
3. BENZINGER, T. H. The quantitative mechanism and the sensory receptor organ of human temperature control in warm environment. Ann. Int. Med. 54:685. 1961.
4. BENZINGER, T. H., PRATT, A. W., and KITZINGER, C. The thermostatic control of human metabolic heat production. Proc. Nat. Acad. Sci. 47:730. 1961.

1962

5. BENZINGER, T. H. Human thermostat. McGraw-Hill Yearbook of Science and Technology. New York, McGraw-Hill Book Co., Inc., 1962.
6. KITZINGER, C., STEINER, R. F., and BENZINGER, T. H. Enthalpy changes during the interaction of polyadenylic and polyuridylic acids. Int. Union Physiol. Sci. Vol. 2. 1962.

1963

7. BENZINGER, T. H. Animal calorimetry: its future. Trans. ASAE 6: 119. 1963.
8. BENZINGER, T. H. Cranial measurements of internal temperature in man. In Temperature - Its Measurement and Control in Science and Industry, Vol. 3, Pt. 3, p. 111-120. New York, Reinhold. 1963.
9. BENZINGER, T. H. Peripheral cold- and central warm-reception, main origins of human thermal discomfort. Proc. Nat. Acad. Sci. 49: 832. 1963.

10. BENZINGER, T. H., and KITZINGER, C. Gradient layer calorimetry and human calorimetry. In Temperature - Its Measurement and Control in Science and Industry, Vol. 3, Pt. 3, p. 87-109. New York, Reinhold. 1963.
11. BENZINGER, T. H., and KITZINGER, C. Microcalorimetry, new methods and objectives. In Temperature - Its Measurement and Control in Science and Industry, Vol. 3, Pt. 3, p. 43-60. New York, Reinhold. 1963.

1964

12. BENZINGER, T. H. The thermal homeostasis of man. In G. W. Hughes, ed. Homeostasis and Feedback-Mechanisms. Cambridge, University Press, 1964. p. 49-80.
13. BENZINGER, T. H. I. The thermostat in man. Bild der Wissenschaft [Image of Science]. p. 50-60. July-Sept. 1964.

1965

14. BENZINGER, T. H. Heatburst-microcalorimetry, a novel tool of chemistry and biochemistry. Fractions, No. 2. 1965.
15. BENZINGER, T. H. II. The thermostat in man. Bild der Wissenschaft [Image of Science]. p. 232-240. Mar. 1965.

PRINCIPAL INVESTIGATOR DANIELLI, DR. J. F.  
AND ADDRESS: State University of New York at  
Buffalo  
Buffalo, New York 14214

CONTRACT NUMBER: NGR 33-015-016

CONTRACT TITLE: Center for Theoretical Biology

1965

1. McMULLEN, A. I. Quantum mechanical interfacial 'trigger' action in macromolecular replication. J. Chem. Phys. 43:S230. 1965.

1966

2. DANIELLI, J. F. On the thickness of lipid membranes. J. Theoret. Biol. 12:439-441. 1966.
3. FRIEDENBERG, R., BLATT, A. J., and GALLUCCI, V. Electrostatics of membrane systems. II. Fixed charge and dipole planar surfaces of finite dimensions. J. Theoret. Biol. 11:478-484. 1966.
4. FRIEDENBERG, R., BLATT, A. J., and GALLUCCI, V. Electrostatics of membrane systems. III. The potential energy functions of idealized models of fixed charge and dipole distributions as related to surface chemical phenomena. J. Theoret. Biol. 11:485-489. 1966.
5. FRIEDENBERG, R., BLATT, A., GALLUCCI, V., DANIELLI, J. F., and SHAMES, I. Electrostatics of membrane systems. I. A non-statistical approach to cellular membrane systems. J. Theoret. Biol. 11:465-477. 1966.
6. McMULLEN, A. I. A theory of DNA membrane interaction. In Abstract of Second International Congress of Biophysics in Vienna, Sept. 1966. p. 695. 1966.
7. McMULLEN, A. I., and MACGILLIVRAY, A. D. On the influence of ionic strength on the melting temperature of DNA. J. Theoret. Biol. 12:260. 1966.
8. McMULLEN, A. I., and MACGILLIVRAY, A. D. A theoretical consideration of the effect of ionic strength on the helix-coil transition. In Abstract of the Third Meeting of the Federation of the European Biochemical Society, Warsaw, p. G-108. 1966.

9. McMULLEN, A. I., and MACGILLIVRAY, A. D. A theoretical study of the role of salt concentration in the melting of DNA. J. Theoret. Biol. 12:75. 1966.
10. McMULLEN, A. I., and MACGILLIVRAY, A. D. A variational approach to the dynamics of the helix-coil transition. Presented at the 40th National Colloid Symposium, Wisconsin, June 1966. (TBC Preprint No. 11). 18 p. 1966.
11. McMULLEN, A. I., REIN, R., and POLLACK, M. Theoretical studies of models concerned with possible mechanisms of replication of DNA. In Abstract of Second International Congress of Biophysics in Vienna, Sept. 1966, p. 137. 1966.

No Date of Publication

12. McMULLEN, A. I., and MACGILLIVRAY, A. D. The influence of ionic strength on the rate of unwinding of DNA. Theoretical Biology Center Preprint No. 4, 10 p.

PRINCIPAL INVESTIGATOR DAYHOFF, DR. M. O.  
AND ADDRESS: National Biomedical Research  
Foundation  
8600 16th Street  
Silver Spring, Maryland 20910

CONTRACT NUMBER: NSR 21-003-002

CONTRACT TITLE: Thermodynamic Properties of Molecular  
Complexes (Biological Analysis)

1964

1. DAYHOFF, M. O., LIPPINCOTT, E. R., and ECK, R. V. Thermodynamic equilibria in prebiological atmospheres. Science 146(3650): 1461-1464. Dec. 11, 1964. 9 Refs.

1966

2. ECK, R. V., and DAYHOFF, M. O. Evolution of the structure of ferredoxin based on living relics of primitive amino acid sequences. Science 152(3720):363-366. Apr. 15, 1966. 13 Refs.

In Press

1966

3. ECK, R. V., LIPPINCOTT, E. R., DAYHOFF, M. O., and PRATT, Y. T. Thermodynamic equilibrium and the inorganic origin of organic compounds. Science. 1966.
4. LIPPINCOTT, E. R., ECK, R. V., DAYHOFF, M. O., and SAGAN, C. Thermodynamic equilibria in planetary atmospheres. Astrophys. Observ. J. 1966.

PRINCIPAL INVESTIGATOR FERNANDEZ-MORAN, DR. H.  
AND ADDRESS: University of Chicago  
Department of Biophysics  
5640 Ellis Avenue  
Chicago, Illinois 60637

CONTRACT NUMBER: NsG-441

CONTRACT TITLE: Integrated Program in Molecular Biology

1962

1. FERNANDEZ-MORAN, H. Cell-membrane ultrastructure. Circulation 26: 1039. Nov. 1962.
2. FERNANDEZ-MORAN, H. Cell-membrane ultrastructure: low temperature electron microscopy and X-ray diffraction studies of lipoprotein components in lamellar systems. In S. R. Korey, ed. Ultrastructure and Metabolism of the Nervous System, A.R.N.M.D. Series 40, p. 338. Baltimore, The Williams and Wilkins Co., 1962.
3. FERNANDEZ-MORAN, H. Molecular basis of specificity in membranes. In F. O. Schmitt, ed. Macromolecular Specificity and Biological Memory, p. 39-48. Cambridge, Mass., M.I.T. Press, 1962.
4. FERNANDEZ-MORAN, H. New approaches in the study of biological ultrastructure by high-resolution electron microscopy. In R. J. C. Harris, ed. Symposia of the International Society for Cell Biology, Vol. 1, p. 411-427. London, Academic Press Ltd., 1962.

1963

5. BLAIR, P. V., ODA, T., GREEN, D. E., and FERNANDEZ-MORAN, H. Studies on the electron transfer systems. LIV. Isolation of the unit of electron transfer. Biochemistry 2:756-764. July 1963.
6. FERNANDEZ-MORAN, H. Biological membranes. In D. I. Eggenberger, ed. McGraw-Hill Yearbook of Science and Technology 1963, p. 323-329. New York, McGraw-Hill Book Co., Inc., 1963.
7. FERNANDEZ-MORAN, H. Subunit organization of mitochondrial membranes. (Abstr.) Science 140:381. 1963.

1964

8. FERNANDEZ-MORAN, H. High resolution low temperature electron microscopy of biological systems. Science 144:431. Apr. 1964.

9. FERNANDEZ-MORAN, H. New approaches in correlative studies of biological ultrastructure by high resolution electron microscopy. J. Roy. Microscop. Soc. 83(1-2):183-195. 1964.
10. FERNANDEZ-MORAN, H., ODA, T., BLAIR, P. V., and GREEN, D. E. A macromolecular repeating unit of mitochondrial structure and function: correlated electron microscopic and biochemical studies of isolated mitochondria and submitochondrial particles of beef heart muscle. J. Cell Biol. 22:63-100. July 1964.
11. FERNANDEZ-MORAN, H., REED, L. J., KOIKE, M., and WILLMS, C. R. Correlated electron microscopic and biochemical studies of a multienzyme complex: pyruvate dehydrogenase complex of Escherichia coli. Science 145:930-932. June 1964.
12. FERNANDEZ-MORAN, H., and YATES, U. Electron microscope - medicine's research tool of unfulfilled promise. J. Amer. Med. Ass. 189: 31-33. Sept. 28, 1964.

1965

13. FERNANDEZ-MORAN, H. Application of high field superconducting solenoid lenses in electron microscopy. (Abstr.) Science 147:665. 1965.
14. FERNANDEZ-MORAN, H. Electron microscopy with high field superconducting solenoid lenses. Proc. Nat. Acad. Sci. 53(2):445-451. Feb. 1965.
15. FERNANDEZ-MORAN, H. Forms of water in biologic systems and the organization of membranes. Ann. N. Y. Acad. Sci. 125(2):739-752. 1965.
16. HASELKORN, R., FERNANDEZ-MORAN, H., KIERAS, F. J., and BRUGGEN, E. F. J. VAN Electron microscopic and biochemical characterization of Fraction I protein. Science 150:1598-1601. Dec. 1965.

1966

17. BRUGGEN, E. F. J. VAN, and FERNANDEZ-MORAN, H. Reassociation of hemocyanins from subunit mixtures. J. Mol. Biol. 16:208-211. Mar. 1966. 5 Refs.
18. COLVILL, A. J. E., BRUGGEN, E. F. J. VAN, and FERNANDEZ-MORAN, H. Physical properties of DNA dependent RNA polymerase from E. coli. J. Mol. Biol. 17:302-304. 1966.
19. FERNANDEZ-MORAN, H. Three new designs improve electron microscopes. In Scientific Research. New York, McGraw-Hill Book Co., Inc., 1966.



20. FERNANDEZ-MORAN, H.. BRUGGEN, E. F. J. VAN, and OHTSUKI, M. Macro-molecular organization of hemocyanins and apohemocyanins as revealed by electron microscopy. J. Mol. Biol. 16:191-207. Mar. 1966. 45 Refs.

In Press

1966

21. FERNANDEZ-MORAN, H. Electron microscopy with superconducting lenses. McGraw-Hill Yearbook of Science and Technology. New York, McGraw-Hill Book Co., Inc., 1966.

PRINCIPAL INVESTIGATOR GOLDMAN, DR. D.  
AND ADDRESS: Naval Medical Research Institute  
National Naval Medical Center  
Bethesda, Maryland 20014

CONTRACT NUMBER: R-134

CONTRACT TITLE: Mechanism of Axonal Conduction on Non-Myelinated Nerve

1965

1. GOLDMAN, D. E. Computation of axon behavior from molecular structure of the membrane. Proc. XXIII Internat. Congr. Physiol. Sci., Tokyo, 1965. (Abstr.) p. 92. 1965.

1966

2. BOORSTIN, J. B., HAYES, J. R., and GOLDMAN, D. E. Injury mechanism of internal organs of animals exposed to sinusoidal vibration. Aerosp. Med. 37(1):22-28. Jan. 1966. 7 Refs.

PRINCIPAL INVESTIGATOR GOODMAN, R. M.  
AND ADDRESS: Franklin Institute  
Benjamin Franklin Parkway  
Philadelphia, Pennsylvania 19103

CONTRACT NUMBER: NSR 39-005-018

CONTRACT TITLE: Life Sciences Instrumentation

1965

1. GIBSON, R. J., GOODMAN, R. M., and MARMAROU, A. A bio-instrumentation system for circadian rhythm studies. In Digest of the Sixth International Conference on Medical Electronics and Biological Engineering, p. 222-223. Tokyo, 1965.

1966

2. GIBSON, R. J., GOODMAN, R. M., HALPERN, M. H., and MARMAROU, A. Instrumentation for biological research. Final report No. F-B2299. Vol. 1, Sect. 1-3. Philadelphia, Pennsylvania, The Franklin Inst. Res. Lab., 1966. 207 p.
3. GIBSON, R. J., GOODMAN, R. M., HALPERN, M. H., and MARMAROU, A. Instrumentation for biological research. Final report No. F-B2299. Vol. II, Sect. 4-5. Philadelphia, Pennsylvania, The Franklin Inst. Res. Lab., 1966. 67 p.
4. GOODMAN, R. M. Biological telecommunications. ASME Publication 66-MD-27. 7 p. 1966.

PRINCIPAL INVESTIGATOR IBERALL, A. S.  
AND ADDRESS: General Technical Services, Inc.  
451 Penn Street  
Yeadon, Pennsylvania 19050

CONTRACT NUMBER: NASw-1066

CONTRACT TITLE: To Develop a Primate Simulator and to  
Develop a Spectral Analyzer for Physiological  
and Medical Use

1964

1. IBERALL, A., and CARDON, S. Control in biological systems. Ann.  
N. Y. Acad. Sci. 114:445. 1964.

No Date Given

2. IBERALL, A., and CARDON, S. Metabolic control in the mammalian  
microcirculation. In Proceedings of the London Symposium on  
the Theory of Self-Adaptive Control Systems, International  
Federation of Automatic Control, 1965.
3. IBERALL, A., and CARDON, S. Regulation and control in biological  
systems. In Proceedings of the Tokyo Symposium on Systems  
Engineering for Control System Design, International Federation  
of Automatic Control, 1965.

PRINCIPAL INVESTIGATOR JUKES, DR. T. H.  
AND ADDRESS: University of California  
Space Sciences Laboratory  
Berkeley, California 94720

CONTRACT NUMBER: NsG-479

CONTRACT TITLE: The Chemistry of Living Systems

1964

1. CHUNG, H., and MANDELES, S. Modifications in the preparation and assay of T<sub>1</sub> ribonuclease. *Biochim. Biophys. Acta* 92:403-405. 1964.
2. JUKES, T. H. Present status of the amino acid code. *J. Amer. Dietetic Ass.* 45:517-522. 1964.
3. RAACKE, I. D., and FIALA, J. Polyribosome-bound nucleoside triphosphatases in Escherichia coli. *Proc. Nat. Acad. Sci.* 51: 323-329. Feb. 1964.
4. RAACKE, I. D., and FIALA, J. Self-sufficiency of natural Escherichia coli polysomes for amino acid incorporation. *Proc. Nat. Acad. Sci.* 52:1283-1289. 1964.
5. TAKANAMI, M. The effect of ribonuclease digests of amino acyl-sRNA on a protein synthesis system. *Proc. Nat. Acad. Sci.* 52:1271-1276. 1964.

1965

6. JUKES, T. H. Coding triplets and their possible evolutionary implications. *Biochem. Biophys. Res. Comm.* 19:391-396. 1965.
7. JUKES, T. H. Coding triplets in the evolution of the hemoglobin and cytochromes c genes. In S. W. Fox, ed. *The Origin of Prebiological Systems*, p. 407-436. Academic Press, 1965.
8. JUKES, T. H. The genetic code II. *Amer. Sci.* 53(4):477-487. Dec. 1965.
9. KRAKOW, J. Azotobacter vinelandii RNA polymerase. I. Inhibition by Congo Red. *Biochim. Biophys. Acta* 95:532-537. 1965.
10. MATSUBARA, H., SINGER, A., SASAKI, R., and JUKES, T. H. Observations on the specificity of a thermostable bacterial protease "Thermolysin". *Biochem. Biophys. Res. Comm.* 21:242-247. 1965.

11. RAACKE, I. D. Comparative studies on "Ribosomal" nucleoside triphosphatases. Fed. Proc. 24:603. 1965.
12. RAACKE, I. D., and FIALA, J. Effects of 'preincubation' on the distribution of different enzymes in extracts of E. coli. Nature 205:1072-1074. 1965.
13. SINGER, B., and FRAENKEL-CONRAT, H. Action of polynucleotide phosphorylase on TMV-RNA. Fed. Proc. 24:603. 1965.
14. SINGER, B., SHERWOOD, M., and FRAENKEL-CONRAT, H. Studies of nucleotide sequences in TMV-RNA II. The action of spleen phosphodiesterase. Biochim. Biophys. Acta 108:306-308. 1965.
15. TAKANAMI, M., and YAN, Y. The release of polypeptide chains from ribosomes in cell-free amino acid-incorporating systems by specific combinations of bases in synthetic polyribonucleotides. Proc. Nat. Acad. Sci. 54(5):1450-1458. 1965.
16. TAKANAMI, M., YAN, Y., and JUKES, T. H. Studies on the site of ribosomal binding of f2 bacteriophage RNA. J. Mol. Biol. 12: 761-773. 1965.
17. TAKANAMI, M., YAN, Y., and JUKES, T. H. Studies on the site of ribosomal binding of messenger RNA. Fed. Proc. 24:654. 1965.
18. YOSHIKAWA, H. DNA synthesis during germination of Bacillus subtilis spores. Proc. Nat. Acad. Sci. 53:1476-1483. 1965.

1966

19. CANTOR, C., and JUKES, T. H. The repetition of homologous sequences in the polypeptide chains of certain cytochromes and globins. Proc. Nat. Acad. Sci. 56(1):177-184. July 1966.
20. CANTOR, C., and JUKES, T. H. Repetitions in the polypeptide sequence of cytochromes. Biochem. Biophys. Res. Comm. 23:319-323. 1966.
21. JUKES, T. H. Teaching biology today. Poultry Sci. 45:483. 1966.
22. KAMMEN, H. O. A rapid assay for thymidylate synthetase. Anal. Biochem. 17(3):554-556. Dec. 1966.
23. KRAKOW, J. S. Azotobacter vinelandii RNA polymerase. II. Effect of ribonuclease on polymerase activity. J. Biol. Chem. 241:1830-1834. 1966.
24. KRAKOW, J. S. Studies on the role of SH groups in the Azotobacter vinelandii RNA polymerase. Fed. Proc. 25:275. 1966.
25. MANDELES, S., and WOODS, E. Continuous countercurrent dialysis of large volumes. Anal. Biochem. 15:523-529. June 1966.

26. RAACKE, I. D. Ribonucleoside triphosphatases in rabbit reticulocytes. Arch. Biochem. Biophys. 113:367-370. 1966.
27. SINGER, B., and FRAENKEL-CONRAT, H. Photo-inactivation of TMV-RNA with thiopyronin or proflavin. Fed. Proc. 25:783. 1966.

In Press

1966

28. KRAKOW, J. S., and HORSLEY, W. The isolation and properties of the DNA dependent RNA polymerase from Azotobacter vinelandii. Methods in enzymology and nucleic acids. New York, Academic Press, 1966.
29. MAESTRE, M. F. Electro-optic studies on bacteriophage structure. In Colloquium Symposium of the American Chemical Society. 1966.
30. MANDELES, S., and CANTOR, C. Base composition of intact nucleic acid oligomers. Biopolymers. 1966.
31. MATSUBARA, H. Observations on the specificity of thermolysin with synthetic peptides. Biochem. Biophys. Res. Comm. 1966.
32. MATSUBARA, H., SASAKI, R., SINGER, A., and JUKES, T. H. Specific nature of hydrolysis of insulin and tobacco mosaic virus protein by thermolysin<sup>1</sup>. Arch. Biochem. 1966.
33. OCHOA, S., and JUKES, T. H. The genetic code. Ergeb. Physiol. 1966.
34. SMITH, K., and YOSHIKAWA, H. Variation in the photochemical reactivity of thymine in the DNA of B. subtilis spores, vegetative cells and spores germinated in chloramphenicol. Photochem. Photobiol. 1966.
35. TAKANAMI, M. Analysis of the 5'-terminal nucleotide sequences of ribonucleic acids. J. Mol. Biol. 1966.
36. TAKANAMI, M. The 5-termini of E. coli ribosomal RNA and f2 bacteriophage RNA. Presented at the Cold Spring Harbor Symposium of Quantitative Biology Meeting, June 2-9, 1966. Cold Spring Harbor Symposium of Quantitative Biology, Vol. 30. 1966.

PRINCIPAL INVESTIGATOR LINDBERG, DR. R. G.  
AND ADDRESS: Northrop Corporation  
3401 West Broadway  
Hawthorne, California 90250

CONTRACT NUMBER: NASw-812

CONTRACT TITLE: To Investigate the Use of Perognathus  
as an Experimental Organism for Space  
Biology Research

1964

1. GAMBINO, J. J., and LINDBERG, R. G. Response of the pocket mouse to ionizing radiation. Radiat. Res. 22(4):586-597. Aug. 1964.

1965

2. CHEW, R. M., LINDBERG, R. G., and HAYDEN, P. Circadian rhythm of metabolic rate in pocket mice. J. Mammalogy 46:477-494. 1965.
3. GAMBINO, J. J., LINDBERG, R. G., and HAYDEN, P. A search for mechanisms of radiation resistance in pocket mice. Radiat. Res. 26:305-317. 1965.
4. LINDBERG, R. G., DE BUONO, G. J., and ANDERSON, M. M. Animal temperature sensing for studying the effect of prolonged orbital flight on the circadian rhythms of pocket mice. J. Spacecraft & Rockets 2:986-988. 1965.

In Press

1966

5. HAYDEN, P., and GAMBINO, J. J. Laboratory breeding of the little pocket mouse, Perognathus longimembris. J. Mammalogy. 1966.

No Date Given

6. HAYDEN, P., GAMBINO, J. J., and LINDBERG, R. G. Growth and development of the little pocket mouse, Perognathus longimembris. Growth.



PRINCIPAL INVESTIGATOR MERYMAN, DR. H. T.  
AND ADDRESS: Naval Medical Research Institute  
National Naval Medical Center  
Bethesda, Maryland 20014

CONTRACT NUMBER: R-63

CONTRACT TITLE: Freezing and Drying of Living Cells

1964

1. MERYMAN, H. T. Mechanisms of resistance of poikilothermic animals to subfreezing temperatures. In The Cell and Environmental Temperature, p. 81-85. Moscow-Leningrad, U.S.S.R. Academy of Sciences, 1964.

1965

2. MERYMAN, H. T. Freeze-drying of human erythrocytes. In Progress in Refrigeration, Science and Technology: Proceedings of XIth International Congress of Refrigeration, Munich 1963, Vol. 2, p. 1609-1611. Oxford, Pergamon Press, 1965.
3. WILLIAMS, R. J., and MERYMAN, H. T. A calorimetric method for measuring ice in frozen solutions. Cryobiology 1:317-323. 1965.

1966

4. MERYMAN, H. T. Freeze-drying. In H. T. Meryman, ed. Cryobiology, p. 609-663. London, Academic Press, 1966.
5. MERYMAN, H. T. The relationship between dehydration and freezing. In H. T. Meryman, ed. Cryobiology, p. 1-114. London, Academic Press, 1966.

In Press

1966

6. MERYMAN, H. T. The relationship between dehydration and freezing injury in the human erythrocyte. In Proc. Inst. Low Temp. Sci. Hokkaido, University of Sapporo, 1966.

PRINCIPAL INVESTIGATOR POLLARD, DR. E. C.  
AND ADDRESS: Pennsylvania State University  
618 Life Sciences Building  
University Park, Pennsylvania 16802

CONTRACT NUMBER: NsG-324

CONTRACT TITLE: Physics of Cellular Synthesis, Growth  
and Division

1964

1. BOCKRATH, R. C. JR., and PERSON, S. R. The nature of bacterial revertants produced by the decay of incorporated tritium compounds in Escherichia coli. Mutation Res. 1:373-380. 1964.
2. PERSON, S., and BOCKRATH, R. C. JR. Differential mutation production by the decay of incorporated tritium compounds in Escherichia coli. Biophys. J. 4:355-365. 1964.
3. POLLARD, E. C. Ionizing radiation: effect on genetic transcription. Science 146:927-929. 1964.
4. YEISLEY, W. G., and POLLARD, E. C. An analog computer study of differential equations concerned with bacterial cell synthesis. J. Theoret. Biol. 7:485-503. 1964.

1965

5. EDGELL, M. H., and GINOZA, W. The fate during infection of the coat protein of the spherical bacteriophage R17. Virology 27:23-27. 1965.
6. GINOZA, W., and MILLER, R. C. Kinetics of X-ray and heat inactivation of ØX174 RF-DNA. Proc. Nat. Acad. Sci. 54:551-558. 1965.
7. LEHMAN, R. C., and POLLARD, E. C. Diffusion rates in disrupted bacterial cells. Biophys. J. 5:109-119. 1965.
8. PERSON, S., and BOCKRATH, R. C. Evidence for a mutagenic local effect accompanying the decay of incorporated tritium in Escherichia coli. J. Mol. Biol. 13:600-602. 1965.
9. POLLARD, E. C. The fine structure of the bacterial cell and the possibility of its artificial synthesis. Amer. Sci. 53:437-463. 1965.

10. POLLARD, E. C. Theoretical studies on living systems in the absence of mechanical stress. J. Theoret. Biol. 8:113-123. 1965.
11. POLLARD, E. C., EBERT, M. J., MILLER, C., KOLACZ, K., and BARONE, T. F. Ionizing radiation: effect of irradiated medium on synthetic processes. Science 147:1045-1047. 1965.
12. POLLARD, E. C., and LEMKE, M. Rate of mutation to phage resistance in  $^2\text{H}_2\text{O}$  medium. Mutation Res. 2:213-217. 1965.
13. PRUDEN, B., SNIPEs, W., and GORDY, W. Electron spin resonance of an irradiated single crystal of thymidine. Proc. Nat. Acad. Sci. 53:917-923. 1965.
14. SNIPEs, W., and BERNHARD, W. Electron spin resonance transitions involving simultaneous changes in spin states of two neighboring protons. J. Chem. Phys. 43:2921-2922. 1965.

1966

15. BERNHARD, W., and SNIPEs, W. Electron spin resonance of a gamma-irradiated single crystal of barbituric acid dihydrate. J. Chem. Phys. 44(7):2817-2820. Apr. 1, 1966.
16. POLLARD, E. C. The action of ionizing radiation on post-irradiation of DNA synthesis and degradation in E. coli 15 T L. Radiat. Res. 27:419. 1966.

1967

17. DEERING, R. A., and TRASK, M., ed. The molecular aspects of biological development. Washington, D. C., Nat. Aeron. Space Admin., Feb. 1967. 201 p. (NASA CR-673)

No Date Given

18. POLLARD, E. C. The degradation of RNA by ionizing radiation in dilute solution. Nature.
19. POLLARD, E. C., SWEZ, J., and GRADY, L. Physical characteristics of the residual DNA in bacterial cells after degradation due to ionizing radiation. Radiat. Res.
20. POLLARD, E. C., and WELLER, P. K. The effect of hydrostatic pressure on the synthetic processes in bacteria. Biochim. Biophys. Acta.
21. SNIPEs, W., and SCHMIDT, J. Free radical formation in amino acids exposed to thermal hydrogen atoms. Radiat. Res.
22. SWEZ, J., and POLLARD, E. C. DNA agar annealing of residual DNA after degradation by ionizing radiation. Radiat. Res.

PRINCIPAL INVESTIGATOR STRYER, L.  
AND ADDRESS: Stanford University  
Palo Alto, California

CONTRACT NUMBER: NGR 05-020-137

CONTRACT TITLE: Proteins and Amino Acids, Structure  
and Function

1967

1. HAUGLAND, R. P., STRYER, L., STENGLE, T. R., and BALDESHWIELER, J. D. Nuclear magnetic resonance studies of antibody-hapten interactions using a chloride ion probe. Biochemistry 6(2):498-502. Feb. 1967.
2. STRYER, L., HOLMGREN, A., and REICHARD, P. Thioredoxin. A localized conformational change accompanying reduction of the protein to the sulfhydryl form. Biochemistry 6(4):1016-1020. Apr. 1967.

PRINCIPAL INVESTIGATOR THOROGOOD, DR. E.  
AND ADDRESS: University of Pennsylvania  
Department of Biology  
Philadelphia, Pennsylvania 19104

CONTRACT NUMBER: NsG-335

CONTRACT TITLE: Molecular Biology of Nitrogen Fixing  
Nodules of Common Crop Legumes

1963

1. THOROGOOD, E. A spectrophotometric study of the ionization in two ferrihaemoproteins from soya-bean nodules. Biochem. J. 87:114-123. 1963.
2. THOROGOOD, E., and HANANIA, G. I. H. Thermodynamic quantities for the dissociation of three ferrihaemoproteins from soya-bean nodules. Biochem. J. 87:123-127. 1963.

PRINCIPAL INVESTIGATOR WALD, DR. N.  
AND ADDRESS: University of Pittsburgh  
Graduate School of Public Health  
Pittsburgh, Pennsylvania 15213

CONTRACT NUMBER: NASr-169

CONTRACT TITLE: Automatic Analysis of Cytogenic Material

1965

1. WALD, N., FEAGIN, F., and RANSHAW, R. Automation of human cytogenetic study methodology. In Digest of the 6th International Conference on Medical Electronics and Biological Engineering, 1965, p. 152-153. Tokyo, 1965.
2. WALD, N., and PAN, S. F. The adaptation of cytogenetic methodology for monitoring biologic radiation effects. Health Phys. 11(8): 798. Aug. 1965.

1966

3. WALD, N., FEAGIN, F., and RANSHAW, R. Automated chromosome analysis in radiobiologic research and monitoring. In Proceedings of the Third International Congress of Radiation Research, Cortina, Italy, June 1966. (Abstr.) p. 233. 1966.

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## PREFACE

The Bioscience Programs Division of the National Aeronautics and Space Administration is employing the efforts of outstanding professional scientists in the preparation of a monograph series relating to the principles and problems of space bioscience. This document series, entitled "Foundations of Space Biology and Medicine", currently consists of the nineteen monographs covering in scope every known significant aspect of space which may directly or indirectly concern biological organisms and their study.

These comprehensive endeavors require the compilation of an immense store of evaluated data from many available information resources. The George Washington University is cooperating with the NASA in this effort by providing the services of the BSCP's Biospace Data Bank to each monograph compiler. The Data Bank consists of directories of organizations and scientists previously or currently involved with the biospace effort, a small measure of their interests and previous endeavors, bibliographic information on the biospace sciences and a depository of research progress reports of the NASA's supported bioscience investigations. "Radiobiology, a Selected Bibliography" is one result of this cooperative effort specifically designed to provide supporting information for the monographs "Effect on the Organism of Radiant Energy from Cosmic Space", and "Protection of Man Against Adverse Flight Factors", although other monograph authors may benefit from its contents.

No claim is made regarding the comprehensiveness of this report. It contains 514 radiobiology references drawn from the bibliographic section of the Biospace Data Bank which may be pertinent to the investigation of space science. Only papers from 1959 to date are included. An author index and permuted title index (with appropriate descriptors added) facilitate the use of this bibliography by providing rapid entry to the more specific items of interest to the reader. The title of each article referenced in this report has been rotated according to each key word and alphabetized. Key words were added where they were implied by the study, but not mentioned in the given title and are indicated by parentheses. Thus, the article titled "Effects of ionizing radiation on protein synthesis in the cell", would be indexed in the following manner:

(Biochemistry) Effects of ionizing radiation on protein	32
cell/Effects of ionizing radiation on protein synthesis	32
ionizing radiation on protein synthesis in the cell/Eff	32
protein synthesis in the cell/Effects of ionizing radia	32
radiation on protein synthesis in the cell/Effects of i	32
synthesis in the cell/Effects of ionizing radiation on	32

The slash indicates the break between the first and last words in the title and the number at the right refers to the bibliographic citation number.

## RADIOBIOLOGY, A SELECTED BIBLIOGRAPHY

1959

1. BAKH, I., GORLOV, O., YAKOVLEV, V., and others. Man in space: medical-biological problems in space flights. Rept. No. ATIC-1256169. Air Technical Intelligence Center, Wright-Patterson AFB, Ohio. Oct. 7, 1959. 35 p.
2. BELTRAN, A. A. Man in space - special bibliography. Rept. No. SB-59-42. Lockheed Missiles and Space Co., Sunnyvale, Calif. Sept. 14, 1959. 16 p.
3. CHRISTMAN, H. H. Environmental control key to success of the manned earth satellite. Heating, Piping, and Air Conditioning 31(10): 151-166. Oct. 1959.
4. CLARK, R. T. JR. Prompt effects of high-level irradiation on animal metabolism. Sch. Aviat. Med., Brooks AFB, Tex. Aug. 14, 1959. 10 p.
5. KIRCHER, J. F., and MCNULTY, J. S. The effects of radiation on oxygen designed for human consumption. Rept. No. WADC TR 59-618. Report on Health Hazards of Materials and Radiation. Dec. 1959. 33 p.
6. LANGHAM, W. H. Implications of space radiations in manned space flights. Aerosp. Med., June 1959, p. 410-417.
7. PICKERING, J. E. Prompt effects of high-level irradiation on animal metabolism. Rept. No. AF-SAM-60-17. Sch. Aviat. Med., Brooks AFB, Tex. Aug. 14, 1959. 10 p.
8. SCHAEFER, H. J. Tissue depth doses in the high-intensity proton radiation field of the inner Van Allen belt. Rept. No. 16. Naval Sch. Aviat. Med., Pensacola, Fla. 1959. 12 p.
9. SIMONS, D. G. Radiation dosage in flight through the Van Allen belt. (Abstr.) J. Aviat. Med. 30(9):201-202. Mar. 1959.
10. SIPOVSKIY, P. V., and FUNSHTEYN, L. V. Importance of orthostatic disturbances in rabbits subjected to total x-ray radiation. Med. Radiol. (Moscow) 4(3):80-81. 1959. In Russian.
11. TRAVERS, S. Would the circumterrestrial belts be a mortal danger for our future astronauts? American, Russian, and French experiences and theories. Fusees (Paris) 14:155-162. Nov. 1959. In French.
12. VERNOV, S. H., CHUDAKOV, A. YE., VAKULOV, P. V., and LOGACHEV, YU. I. A study of terrestrial corpuscular radiation and cosmic rays during space rocket flight. Dokl. Akad. Nauk SSSR 125:304-307. 1959.

13. YAGODA, H., and others. Observations on mice exposed to cosmic radiation in the atmosphere: a longevity and pathological study of 85 mice. Milit. Med. 124:835-847. Dec. 1959.

14. CALKINS, K. Shields for space travelers. Boeing Mag. 30(11): 10-11. Nov. 1960.
15. CAMPBELL, P. A. Medical aspects of ambient radiations of extra-terrestrial space. J. Amer. Med. Ass. 172(7):668-671. Feb. 13, 1960.
16. CARTER, J. W. Some select physiological, anthropometric, and human engineering data useful in vehicle design and logistic problems of space flight operations. Army Missile Command, Redstone Arsenal, Huntsville, Ala. Feb. 24, 1960. 34 p.
17. DOW, N. F. The ionizing radiation in space: structural implications. Aero/Space Eng. 19(5):46-47, 98. May 1960.
18. DOW, N. F. Structural implications of the ionizing radiation in space. In Proceedings of the Manned Space Stations Symposium, Los Angeles, Calif., Apr. 20-22, 1960, p. 128-136. New York, Institute of Aeronautical Sciences, 1960.
19. JACOBS, G. J., ed. Proceedings of the Conference on Radiation Problems in Manned Space Flight, June 21, 1960. NASA Tech. Note D-588. Washington, D. C., 1960. 99 p.
20. KNAUF, G. M. The bio-effects of radar energy. Aerosp. Med. 31(3): 225-288. 1960.
21. LANGHAM, W. H. Some radiation problems of space conquest. Astronaut. Sci. Rev. 2(4):9-18. Oct.-Dec. 1960.
22. NEWELL, H. E. Radiation environment in space: satellites and space. probes are revealing the kinds and amounts of radiation men will encounter in space. Science 132(3438):1465-1472. 1960.
23. NEWELL, H. E., and NAUGLE, J. E. Results of satellite and space probe observations of radiation environment. In Proceedings of the SAE-AFOSR Astronautic Symposium, Los Angeles, Calif., Oct. 12-14, 1960. 9 p. [1960]
24. NEWSOM, B. D., and KIMELDORF, D. J. Tolerance of irradiated animals to prolonged hypoxia. Amer. J. Physiol. 199(3):445-448. 1960.
25. NOYES, J. C., and BROWN, W. D. Shielding requirements for radiation belt particles. Rept. No. DI-82-0048. Boeing Scientific Res. Lab., Seattle, Wash., Jan. 1960. 28 p.
26. PICKERING, J. E., MELVILLE, G. S. JR., YOUNG, R. J., and BARELLA, H. Effects of chronic low-dose neutron irradiation upon peripheral blood elements in the monkey (Macaca mulatta). Rept. 60-60. Sch. Aviat. Med., ATC, Randolph AFB, Tex., Aug. 1960. 13 p.
27. PICKERING, J. E., and ZELLMER, R. W. Biologic effects of nuclear radiation in primates. Rept. 60-66. Sch. Aviat. Med., ATC, Randolph AFB, Tex., Aug. 1960. 12 p.

28. RIETHOF, T. R. Charged particle radiation in space. General Electric Co., Missile and Space Vehicle Dept., Philadelphia, Penna., Aug. 1960. 133 p.
29. ROBEY, D. H. Radiation shield requirements for two large solar flares. Astronaut. Acta 6:206-224. 1960.
30. SCHAEFER, H. J. Further evaluation of tissue depth dose in proton radiation fields in space. Rept. No. 17. Naval Sch. Aviat. Med., Pensacola, Fla., 1960. 14 p.
31. SCHAEFER, H. J. Radiation danger in space. Astronautics 5(7): 36, 42-45. 1960.
32. SCHAEFER, H. J. Tissue ionization dosages in proton radiation fields in space. Aerosp. Med. 31(10):807-816. 1960.
33. SCHAEFER, H. J., and GOLDEN, A. Solar influence on the extra-atmospheric radiation field and their radiobiological implications. In O. O. Benson and H. Strughold, eds. Physics and Medicine of the Atmosphere and Space, p. 157-181. New York, John Wiley & Sons, 1960.
34. STRUGHOLD, H., and RITTER, O. L. Solar irradiance from Mercury to Pluto. Aerosp. Med. 31(2):127-130. 1960.
35. STUBBS, R. A. Some engineering considerations for the manned orbiting vehicle. Can. Aeronaut. J. 6(9):375-379. Nov. 1960.
36. TAYLOR, J. W. X-irradiation and acceleration stress. Rept. No. 1 on Task MR005 15-0002.14. Aviat. Med. Accel. Lab., Naval Air Development Center, Johnsville, Penna., Mar. 1960. 9 p.
37. TOBIAS, C. A., and BRUSTAD, T. Radiobiological studies with accelerated heavy ions. In O. O. Benson and H. Strughold, eds. Physics and Medicine of the Atmosphere and Space, p. 193-208. New York, John Wiley & Sons, 1960.
38. VAN ALLEN, J. A. On the radiation hazards of space flight. In O. O. Benson and H. Strughold, eds. Physics and Medicine of the Atmosphere and Space, p. 1-13. New York, John Wiley & Sons, 1960.
39. WHILLIAMS, M. G. Biosciences research and space problems. J. Roy. Astron. Soc. 54(5):211-215. Oct. 1960.

40. ANDERSON, K. A., and FICHTEL, C. E. Discussions of solar proton events and manned space flight. Nat. Aeron, Space Admin., Washington, D. C., 1961. 11 p.
41. BALLINGER, J. C., and CHRISTENSEN, E. H. Environmental control of study of space vehicles. II. Thermal environment of space. Suppl. B. Tablar Presentation of planetary thermal and planetary albedo radiation incident to space vehicles. Rept. No. ERR-AN-016, Suppl. B. General Dynamics/Astronautics, San Diego, Calif., Jan. 1961. 129 p.
42. BARBIERI, L. J., and others. The interdependence of manned spacecraft design and radiation shielding. Aero/Space Eng. 20(4): 14-15. Apr. 1961.
43. BARTON, J. A. An estimate of the nuclear radiation at the lunar surface. Advan. Astronaut. Sci. 6:794-804. 1961.
44. BOND, A. F., and others. Methods of predicting radiation dosage in space flights. Advan. Astronaut. Sci. 6:302-316. 1961.
45. CHASE, H. B., STRAILE, W. E., and ARSENAULT, C. V. Heavy ion and millibeam irradiation on mammalian tissue. In: Symposium on Aerospace Radiobiology. Aerosp. Med. 32(10):921-924. 1961.
46. DE BUSK, A. G. VI. Genetic studies in the lower radiation belt. In: Symposium on Aerospace Radiobiology. Aerosp. Med. 32(10): 925-931. 1961.
47. DEERING, R. A., HUTCHINSON, F., and SCHAMBRA, P. E. IV. Biological effects of accelerated heavy ions. In: Symposium on Aerospace Radiobiology. Aerosp. Med. 32(10):915-920. 1961.
48. DUGAS, D. J. Solar-flare radiation and manned space flight. In RAND Research Memorandum 2825-PR, Santa Monica, Calif., 1961. 23 p.
49. EVANS, R. D. Principles for the calculation of radiation dose rates in space vehicles. Rept. No. 63270-05-01. Cambridge, Mass., Mass. Inst. Technol., July 1961. 90 p.
50. EVANS, T. C. Electromagnetic radiation. In Medical and Biological Aspects of Space, p. 415-420. New York, Columbia University Press, 1961.
51. EVVARD, J. C. Space physics: environment for manned space flight. Aero/Space Eng. 20(12):9, 79. Dec. 1961.
52. GANGULY, N. K. Shielding manned space vehicles from space radiations. J. Brit. Interplanet. Soc. 18(3):110-114. May-June 1961.

53. GANSHINA, A. Data on the combined effect of radiation and vibration on the organism of animals. Med. Radiol. 5:71. 1961.
54. LANGHAM, W. H. Some radiation problems of space conquest. Astronautik 2(4):272-294. 1961.
55. MAQSOOD, M. Biological hazards of radiation in space. Scientist (Pakistan) 4(1/2):44-47. 1961.
56. PICKERING, J. E., YOUNG, R. J., MELVILLE, G. S. JR., and BORELLA, H. Hematologic effects induced by periodic exposures of monkeys (Macaca mulatta) to gamma rays. Rept. 61-53. Sch. Aviat. Med., ATC, Randolph AFB, Tex., Mar. 1961. 11 p. 22 Refs.
57. REITZ, D. Cosmic rays, nuclear reactors, and manned space systems. Aero/Space Eng. 20(4):28-29, 77-94, 96. Apr. 1961.
58. RITTER, O. L. The sun's retina-burning power in space. Astronautik (Stockholm) 2(4):300-309. 1961.
59. ROSEN, A. Geomagnetically trapped radiation and interplanetary cosmic flux: the radiation environment in the interior of a space vehicle. In Medical and Biological Aspects of the Energies of Space, p. 90-129. New York, Columbia University Press, 1961.
60. SCHAEFER, H. J. A note on the RBE of proton radiation in space. Rept. No. 18. Naval Sch. Aviat. Med., Pensacola, Fla., Jan. 10, 1961. 11 p.
61. SCHAEFER, H. J. Proton radiation hazards in space. Astronautics 6(2):39, 62-68. 1961.
62. SCHAEFER, H. J. Radiation tolerance criteria in space operations. Rept. No. 20. Naval Sch. Aviat. Med., Pensacola, Fla., 1961. 16 p.
63. SCHAEFER, H. J. The role of the time factor in the dosimetry of ionizing radiation in space, Aerosp. Med. 32:909-914. 1961.
64. SHEN, S. P. Symposium on aerospace radiobiology. II. On the shielding of cosmic rays. Aerosp. Med. 32:901-908. Oct. 1961.
65. WALLNER, L. E., and KAUFMAN, H. R. Radiation shielding for manned space flight. Tech. Note No. D-681. Nat. Aeron. Space Admin., Washington, D. C., July 1961. 45 p. 56 Refs.
66. WINCKLER, J. R. Symposium on aerospace radiobiology: solar influences on the radiation field in space. Aerosp. Med. 32: 893-900. Oct. 1961. 14 Refs.
67. ZELLMER, R. W. Human ability to perform after acute sublethal radiation. Milit. Med. 126:681-687. Sept. 1961. 18 Refs.



1962

68. APPLEMAN, H. S. Radiation effects on manned space flight. Bull. Amer. Meteorol. Soc. 43:39-46. 1962.
69. BAUM, S. J. Recommended ionizing radiation exposures for early exploratory space missions. Aerosp. Med. 33:1182-1186. Oct. 1962.
70. BROOKS AIR FORCE BASE, Texas, School of Aerospace Medicine. Radiobiologic experiments in Discoverer satellite XVIII. Mar. 1962. 38 p.
71. COGAN, D. G. Aerospace problems. Arch. Ophthalmol. 67(5):546. May 1962.
72. CRAWFORD, G. W. Radiobiologic experiments in Discoverer satellite XVII. Rept. No. 62-67. Sch. Aerosp. Med., Brooks AFB, Tex., June 1962. 50 p.
73. DAVIS, N. S., SILVERMAN, G., GOLDBLITH, S. A., and others. Effects of simulated space environments on the viability of microorganisms. Quarterly Status Rept., Apr. 16, 1962-July 15, 1962. National Research Corporation, Cambridge, Mass., Sept. 19, 1962. 25 p. Refs.
74. DONLAN, V. L. The proton hazard in space-biological doses. Directorate of Materials and Processes, Aeronautical Systems Division, Wright-Patterson AFB, Ohio, May 1962. 13 p.
75. FIX, R. C., and others. Relative biological effectiveness of extremely energetic protons and alpha particles. Final Rept. Controls for Radiation, Inc., Cambridge, Mass., Feb. 1962. 80 p.
76. FOX, S. W., HESS, S. L., and METZ, C. B. Study of organisms under terrestrial and extraterrestrial conditions. Florida State University, Inst. Space Biosci., Tallahassee, Fla., Mar. 15, 1962. 12 p. Refs.
77. GYURDZHIAN, A. In the battle with radiation hazard. Krasnaya Zvezda, p. 3. Aug. 21, 1962.
78. JANASH, E. R. Safety in space. Nat. Aeron. Space Admin., Lewis Research Center, Cleveland, Ohio, 1962. 24 p.
79. JOINT PUBLICATIONS RESEARCH SERVICE, Washington, D. C. Study of radiation sickness. Jan. 1963. 12 p. 4 Refs. Transl. from Patol Fiziol. Eksp. Ter. 6(5):60-63; 74-75. 1962.
80. LANGHAM, W. H. Some radiobiological aspects of early manned space flight. In Proceedings of the Lunar and Planetary Exploration Colloquium, Santa Monica, Calif., May 23-24, 1962. p. 117-134. Downey, Calif., North American Aviation Inc., 1962. 27 Refs.

81. LEVENGOOD, W. C., and SHINKLE, M. P. Solar flare effects on living organisms confined in magnetic fields. *Nature* 195:967-970. 1962.
82. MCLAUGHLIN, J. T. Health hazards from microwave radiation. *West. Med.* 3:126-132. 1962.
83. MILLER, J. W. Visual problems of space travel. Armed Forces-NRC Vision Committee, Washington, D. C., Apr. 1, 1962. 55 p.
84. MORRIS, F. M. Visual aspects of space flight. *Amer. J. Optom. Arch. Amer. Acad. Optom.* 39(12):643-652. Dec. 1962. 15 Refs.
85. NEARY, G. J., and HULSE, E. V. Biological hazards of radiation applicable to man in space. *In* Proc. First Int. Symp. on Basic Environmental Problems of Man in Space, Paris, 1962. p. 267-283; discussion, p. 283-284. 1962. 50 Refs.
86. PAUL, J. Hazards of space flight. *Ordnance* 46:703-705. Mar.-Apr. 1962.
87. PHILLIPS, R. D., KIMELDORF, D. J., and JONES, D. C. The relative potency of fast neutrons and 250 KVP x-rays in the guinea pig. Tech. Rept. No. 576. Naval Radiol. Def. Lab., San Francisco, Calif., 1962. 32 p.
88. POGRUND, R. S. Physiological aspects of the spaceman. *In* K. Brown and L. D. Ely, eds. *Space Logistics Engineering*, p. 55-135. New York, John Wiley & Sons, 1962.
89. PRINCE, J. E. Biological systems of Discoverer satellites XXIX and XXX. Rept. No. 62-62. Sch. Aerosp. Med., Brooks AFB, Tex., Apr. 1962. 49 p.
90. RUGH, R. Ionizing radiations and congenital anomalies of the nervous system. *Milit. Med.* 127:883-907. 1962.
91. RUSSELL, W. L. An augmenting effect of dose fractionation on radiation-induced mutation rate in mice. *Proc. Nat. Acad. Sci.* 48:1724-1727. 1962.
92. SANDEMAN, T. F. The proton peril. *Spaceflight* 4:115-124. July 1962.
93. SAYLOR, W. P., WINER, D. E., EIWEN, C. J., and CARRIKER, A. W. Space radiation guide, Rept. No. AMRL-TDR-62-86. Aerosp. Med. Res. Lab., Wright-Patterson AFB, Ohio, 1962. 210 p.
94. SCHAEFER, H. J. Protection against the solar flare. *Astronautics* 7:24-25. Aug. 1962.
95. SCHAEFER, H. J. Radiation tolerance criteria in space operations. *ARS J.* 32:771-773. 1962.
96. SHAKHOV, A. A. The effect of cosmic radiation on plant activity. Foreign Tech. Div., Wright-Patterson AFB, Ohio, Oct. 11, 1963. 20 p. Transl. from *Zh. Obshch. Biol.* 23(2):81-89. 1962.

97. SMITH, G. B. Environmental biology. In Proceedings of the NASA-University Conference on the Science and Technology of Space Exploration. Vol. 1, p. 395-398. Nat. Aeron. Space Admin., Washington, D. C., Dec. 1962.
98. SONDHAUS, C. A. Response of mammalian systems to non-uniform space radiation dose. In Lectures in Aerospace Medicine, p. 211-240. Sch. Aerosp. Med., Brooks AFB, Tex., 1962.
99. STUBBS, P. How risky is space travel? New Scientist (London) 16(313):376-377. Nov. 15, 1962.
100. WADDINGTON, C. J. The hazard of corpuscular solar radiation to manned spaceflight. J. Brit. Interplanet. Soc. (London) 18(7): 277-280. Jan.-Feb. 1962.
101. WANG, C. C., LYMAN, J., and TOBIAS, C. A. Relative biologic effectiveness of 730 mev proton particles for acute lethality of mice. In J. H. Lawrence, ed. Biology and Medicine Semiannual Report, Spring 1962, p. 43-49. Lawrence Radiation Laboratory, Livermore, Calif., 1962.
102. YAGODA, H. Bioastronautical measurements of ionizing radiations in space: nuclear emulsion monitoring report. Air Force Cambridge Research Laboratory, Bedford, Mass., Feb. 1962. 28 p. 14 Refs.
103. YAGODA, H. Radiation studies in space with nuclear emulsion detectors. Space Sci. Rev. 1(2):224-277. Oct. 1962.

104. ADEY, W. R. II. Aspects of brain physiology in the space environment. In Proceedings of the First Conference on Brain Function, p. 321-345. Berkeley, Calif., University of California Press, 1963.
105. AMER, N. M. Modification of radiation effects with magnetic fields. In Semiannual Report - Biology and Medicine, Spring 1963, p. 55-58. Berkeley, Calif., University of California, Lawrence Radiation Lab., 1963.
106. ANTIPOV, V. V., EFREMOV, YU. I., NIKITIN, M. D., SAVENKO, Y. A., and SAKSONOV, P. P. Protection from radiation hazards during the flights of spaceships "Vostok-3" and "Vostok-4". [Obespechenie radiatsionnoi bezopasnosti pri poletakh korablei "Vostok-3" i "Vostok-4"]. Kosm. Issled. 1:303-308. Sept.-Oct. 1963. 10 Refs. In Russian.
107. ARSEN'YEVA, M. A., ANTIPOV, V. V., PETROKHIN, V. G., L'VOVA, T. S., ORLOVA, N. N., and IL'INA, S. S. Effects of flight in the second Soviet satellite on the hemopoietic organs of animals. In Problems of Space Biology, p. 227-241. Nat. Aeron. Space Admin., Washington, D. C., Nov. 1963. Refs.
108. ATOMIC ENERGY COMMISSION, Division of Technical Information Extension, Oak Ridge, Tennessee. Proceedings of the symposium on the protection against radiation hazards in space, held in Gatlinburg, Tennessee, Nov. 5-7, 1962. 1963. 898 p. 475 Refs. (Books 1 and 2).
109. BAILY, N. A., and HOALST, K. M. Dosimetry of space radiations. Nucleonics 21(4):68-73. Apr. 1963.
110. BAKAY, L., and BENDIXEN, H. H. Central nervous system vulnerability in hypoxaemic states. Isotope uptake studies. In J. P. Schade and W. H. McMenemy, eds. CIOMS, Selective Vulnerability of the Brain in Hypoxaemia Symposium, p. 63-78. Oxford, England, Blackwell, 1963.
111. BALABUKHA, V. S., ed. Chemical protection of the body against ionizing radiation. New York, Oxford and Co., Pergamon Press, 1963. 168 p.
112. BARNES, C. M. Safety of nuclear systems in space applications. Milit. Med. 128:766-768. Aug. 1963.
113. BEDWELL, T. C., JR., and others. Lectures in aerospace medicine, Feb. 4-8, 1963. Sch. Aerosp. Med., Aerosp. Med. Div., Brooks AFB, Tex., 1963. 425 p. 272 Refs.
114. BERGER, R. Evaluation of radiation effects in space. Ann. N. Y. Acad. Sci. 108(2):482-486. June 29, 1963. 22 Refs.

115. BIERMAN, A. The derivation of a new distribution function in radio-biology. In E. M. Fallone, ed. Proceedings of the Lunar and Planetary Exploration Colloquium, Vol. 3, No. 2, Santa Monica, Calif., May 23-24, 1962. pp. 99-105. ~~Downey, Calif., North American Aviation, Inc., May 5, 1963.~~
116. BLAIR, H. A. The constancy of repair rate and of irreparability during protracted exposure to ionizing radiation. University of Rochester Rept. 621. Rochester, New York, 1963, 18 p.
117. BLIZARD, E. P. Shielding of man in space. In Lectures in Aerospace Medicine, Feb. 4-8, 1963, p. 339-364. Sch. Aerosp. Med., Aerosp. Med. Div., Brooks AFB, Tex., 1963. 7 Refs.
118. BLOIS, M. S. JR., and PATTEE, H. H. Molecular evolution in proto-biological systems, including a search for catalysts and catalytic activity in the intermediate systems which form during the syntheses of low molecular weight organic compounds. Status Report No. 3, Dec. 1, 1962-May 31, 1963. Stanford University, Biophysics Lab., Palo Alto, Calif., July 1963. 3 p. Refs.
119. BOLT, R. O., and CARROLL, J. G. Radiation effects on organic materials. New York, Academic Press, 1963. 576 p.
120. BOUQUET, F. L. JR. The radiation hazard of space. Space/Aeronautics 39(5):72-77. May 1963.
121. BOURNE, G. H. Neuromuscular aspects of space travel. In J. H. U. Brown, ed. Physiology of Man in Space, p. 1-59. New York, Academic Press, 1963.
122. BRUES, A. M. Somatic hazards of radiation. Proc. Amer. Phil. Soc. 107(1):1-4. 1963.
123. BURNS, N. M., CHAMBERS, R. M., and HENDLER, E., eds. Unusual Environmental and Human Behavior-Physiological and Psychological Problems of Man in Space. New York, MacMillan Co., Free Press of Glencoe, 1963. 438 p.
124. CACCIARI, I., and GIOVANNOZZI, SERMANI, G. The metabolism of Chlorella pyrenoidosa during irradiation. ~~The effect of kinetin~~ on catalase activity. (Abstr.) Int. J. Radiat. Biol. 6(4): 367-368. 1963.
125. CAMPBELL, P. A. The environment of the moon. Arch. Environ. Health 6(6):724-729. June 1963.
126. CHAMBERS, F. W. JR. Miniature tissue equivalent ionization chambers and their use. Aerosp. Med. 34(3):193-196. 1963.
127. COBURN, K. R. The environment of a space capsule. J. Roy. Med. Naval Serv. 49:67-73. Spring 1963. 2 Refs.

128. CORKHILL, P. J. Space radiation monitoring system. *Aerosp. Med.* 34:614-617. July 1963.
129. CORRY, J. E., and STOGRYN, D. E. A new analytical method for determining dose rates in absorber systems exposed to space radiation. In E. M. Fallone, ed. *Proceedings of the Lunar and Planetary Exploration Colloquium*, Vol. 3, No. 2, Santa Monica, Calif., May 23-24, 1962. p. 107-116. Downey, Calif., North American Aviation, Incorporated, May 5, 1963.
130. CRAWFORD, G. W. Application of semiconductor radiation detectors to radiobiologic problems. *Sch. Aerosp. Med., Aerosp. Med. Div., Brooks AFB, Tex., Aug. 1963.* 13 p. 28 Refs.
131. CURTIS, H. J. The late effects of radiation. *Proc. Amer. Phil. Soc.* 107(1):5-10. 1963.
132. DAVIS, N. S., SILVERMAN, G. J., and BENNER, F. C. Effects of simulated space environments on the viability of microorganisms. *Quarterly Status Report*, Jan. 16-Apr. 16, 1963. Nat. Res. Corp., Cambridge, Mass., May 9, 1963. 6 p.
133. DE BUSK, A. G. Biosatellite Project. Progress and Status Report on NASA Grant NsG-103-61, Sept. 1, 1962-Feb. 28, 1963. Fla. State Univ., Tallahassee, Fla., May 2, 1963. 3 p.
134. DOLE, S. H. Radiation environment for manned spacecraft. *Report No. P-2691.* Rand Corp., Santa Monica, Calif., 1963. 7 p.
135. EKBERG, D. R. The microclimate of space vehicles (an introduction to space medicine). In Solco Walle Troup, *Medical Biometeorology: Weather, Climate and the Living Organism*, p. 717-731. Amsterdam, Elsevier Publishing Co., 1963.
136. FALLONE, E. M., ed. *Proceedings of the Lunar and Planetary Exploration Colloquium*, Vol. III, No. 2, Santa Monica, Calif., May 23-24, 1962. Downey, Calif., North American Aviation, Incorporated, May 5, 1963. 174 p. 130 Refs.
137. FINK, T., and MILFORD, N. Particles and radiation in the Martian atmosphere. Grumman Aircraft Engineering Corporation, Astro and Geophysics Section, Bethpage, New York, Sept. 1963. 21 p. Refs.
138. FOELSCH, T. Estimates of radiation doses in space on the basis of current data. In R. B. Livingston, A. A. Imshenetskiy, and G. A. Derbyshire, eds. *Space Research III, Proceedings of the Third International Space Sciences Symposium*, Washington, D. C., May 2-8, 1962. p. 48-94. Amsterdam, North-Holland Publishing Co., 1963. 52 Refs.
139. FOELSCH, T. Radiation doses in interplanetary flight. In E. Burgess, ed. *Advances in the Astronautical Sciences*, Vol. 13. p. 90-103. North Hollywood, Western Periodicals Co., 1963. 17 Refs.

140. FOELSCH, T. Protection against solar flare protons. In H. Jacobs, ed. Advances in the Astronautical Sciences, Vol. 8. p. 357-374. New York, Plenum Press, 1963.
141. FREIER, P., and WEBBER, W. R. Radiation hazard in space from solar particles. Science 142(3599):1587-1592. Dec. 20, 1963.
142. FURCHTGOTT, E. Behavioral effects of ionizing radiations: 1955-1961. Psychol. Bull. 69:157-199. 1963.
143. GAMBINO, J. J., and LINDBERG, R. G. Investigation of Perognathus as an experimental organism for research in space biology. First Quarterly Status Report, Oct. 1-Dec. 31, 1963. Northrop Corp., Hawthorne, Calif., 1963. 12 p. Refs.
144. GAMBINO, J. J., and MIYAHARA, N. K. Blood values of pocket mice (Perognathus). In Investigation of Perognathus as an Experimental Organism for Research in Space Biology, p. 84-94. Northrop Corp., Hawthorne, Calif., Aug., 1963. 8 Refs.
145. GARCIA, J., BUCHWALD, N. A., BACH-Y-RITA, C., FEDER, B. H., and KOELLING, R. A. Electroencephalographic responses to ionizing radiation. Science 140(3564):289-290. 1963.
146. GOL'DBERG, YE. D. Average diameter of erythrocytes during chronic action of small doses of ionizing radiation on the human organism. Washington, D. C., Joint Publ. Res. Serv., Apr. 26, 1963. 6 p. Refs. Transl. from Lab. Delo., Moscow, No. 2, p. 9-11. 1963.
147. GOLDMANN, J. B., comp. Radiation effects upon experimental animals, man, and plants: an annotated bibliography, Vol. II, M-Z. Lockheed Missiles and Space Co., Sunnyvale, Calif., Jan. 1963. 440 p. 1963 Refs.
148. GRAHN, D. Late effects in man following exposure to ionizing radiations. In Protection against Radiation Hazards in Space: Proceedings of the Symposium at Gatlinburg, Tenn., Nov. 5-7, 1962. Vol. 71, p. 275-290. Oak Ridge, Tenn., Atomic Energy Commission, Technical Information Extension Div., 1963.
149. GRAYEVSKIY, A. YA. Theoretical aspects of chemical protection of mammals against ionizing radiation (USSR). Zh. Obshch. Biol. 24(1):3-22. Jan.-Feb. 1963.
150. GRAYEVSKIY, A. YA., BARAKINA, N. F., KONSTANTINOVA, M. M., and SMIRNOVA, I. B. Studies of protection of mammals against radiation. Washington, D. C., Joint Publ. Res. Serv., Sept. 6, 1963. 20 p. 27 Refs. Transl. from Zh. Obshch. Biol. 24(3): 182-193. 1963.
151. GRAZIANO, E. E., comp. Ionizing radiation effects on performance capabilities of astronauts: an annotated bibliography. Lockheed Missiles and Space Company, Sunnyvale, Calif., Nov. 1963. 34 p.

152. HARTECK, P., REEVES, R. R. JR., and THOMPSON, B. A. Photochemical problems of the Venus atmosphere. Washington, D. C., Nat. Aeron. Space Admin., June 1963. 42 p. 46 Refs.
153. HAYDEN, P., and GAMBINO, J. J. Metabolic rates of irradiated Perognathus longimembris. In Investigation of Perognathus as an Experimental Organism for Research in Space Biology, p. 77-82. Northrop Corp., Hawthorne, Calif., Aug. 1963. 3 Refs.
154. HESS, W. N. Measurements on neutrons in space. In Neutron Dosimetry. Proceedings of a Symposium, 1962. Vol. 1, p. 103-110. New York, International Publications, Inc., 1963.
155. HINE, C. H. Physiological effects and human tolerances. In M. Honma and H. J. Crosby, eds. A Symposium on Toxicity in the Closed Ecological System, p. 33-53. Palo Alto, Calif., Lockheed Missiles and Space Co., 1963.
156. HUTCHINSON, F. Radiation effects on macromolecules of Biological importance. Ann. Rev. Nucl. Sci. 13:535. 1963.
157. IVANOV, K. V., ZHUKOV, M. V., and MOLCHANOVA, M. G. The effects of accelerations created at the moment of irradiation on the course of acute radiation sickness. In Study of Radiation Sickness, p. 7-9. Washington, D. C., Joint Publ. Res. Serv., Jan. 21, 1963. 4 Refs. Transl. from Patol. Fiziol. Eksp. Ter. 6(5):74-75. Sept.-Oct. 1962.
158. JACKSON, K. L., The lethal effectiveness of a solar flare-type dose distribution delivered to the rat. In Protection Against Radiation Hazards in Space: Proceedings of the Symposium, Gatlinburg, Tenn., Nov. 5-7, 1962, Vol. 1. p. 375-392. Oak Ridge, Tenn., Atomic Energy Commission, Technical Information Extension Div., 1963.
159. JASTROW, R. Results of experiments in space. Space World 4:6. Jan. 1963.
160. KAKUSHKINA, M. L., KOROLEV, N. P., and KUDRYASHOV, YU. B. The protective action of radioprotectors (cysteamine, cystineamine, and AET) on the radiomimetic effect caused by oleic acid oxidation products. Washington, D. C., Joint Publ. Res. Serv., Aug. 6, 1963. 7 p. 10 Refs. Transl. from Dokl. Akad. Nauk SSSR 149(4):973-975. 1963.
161. KELLER, J. W., Long range NASA shielding requirements. In Protection Against Radiation Hazards in Space: Proceedings of the Symposium held at Gatlinburg, Tenn., Nov. 5-7, 1962, Vol. 2. p. 662-681.. Oak Ridge, Tenn., Atomic Energy Commission, Technical Information Extension Div., 1963.
162. KERSLAKE, D. Man against space. Discovery 24:30-35. Oct. 1963.
163. KOSICHENKO, L. P. Twenty-four hour periodicity of mitoses in mice following the action of gamma rays. Washington, D. C., Joint Publ. Res. Serv., Aug. 21, 1963. 8 p. 8 Refs. Transl. from Byull. Eksp. Biol. Med. (Moscow) 55(1):114-117. Jan. 1963.



164. LEBEDINSKIY, A. V., and NEFEDOV, YU. G. Problems of radiation safety of space flights. In Problems of Space Biology, p. 9-25. Washington, D.C., Joint Publ. Res. Serv., Mar. 27, 1963.
165. LIVINGSTON, R. B., IMSHENETSKIY, A. A., and DERBYSHIRE, G. A., eds. Life Sciences and Space Research. Third International Space Sciences Symposium, Washington, D. C., Apr. 30-May 9, 1962, Proceedings. Amsterdam, North-Holland Publishing Co., 1963. 195 p. Refs.
166. LIVSHITS, N. N., MEYZEROV, YE. S., APANASENKO, Z. I., and KUZNETSOVA, M. A. Some data on the role of the time factor in the radiation reactions of the central nervous system. In Problems of Space Biology, p. 311-320. Washington, D. C., Joint Publ. Res. Serv., Mar. 27, 1963. 17 Refs.
167. LOMONACO, T. Recent advances in Italy in the field of aerospace medicine. [Recenti ricerche in Italia nel campo della medicina aeronautica e spaziale]. Riv. Med. Aeronaut. Spaziale 26:5-25. Jan.-Mar. 1963. 123 Refs. In Italian.
168. LOZINA-LOZINSKIY, L. K. Cytological studies in space biology. In Problems of Space Biology, p. 44-50. Washington, D. C., Joint Publ. Res. Serv., Mar. 27, 1963.
169. MADEY, R. A current survey of space radiation hazards to astronauts. In H. Jacobs, ed. Advances in the Astronautical Sciences, Vol. 11. p. 334-366. North Hollywood, Calif., Western Periodicals Co., 1963. 79 Refs.
170. MADEY, R. Shielding against space radiation. Nucleonics 21(5): 56-60. May 1963.
171. MADEY, R., DUNEER, A. G. JR., and KRIEGER, T. J. Proton dose rates in manned space vehicles. In H. Jacobs, ed. Advances in the Astronautical Sciences. Vol. 11. p. 515-516. North Hollywood, Calif., Western Periodicals Co., 1963.
172. MANOILOV, S. YE. Damage to metal-containing enzymes as a primary manifestation of the biological action of penetrating radiation. Tr. Mosk. Obshchest. Ispyt. Priro. (Moscow) 7(2):30-41. 1963.
173. MEIGS, J. R. Investigation of the effects of ionizing radiation on the central nervous system in vivo and invvitro. First Quarterly Status Report, July 16-Oct. 18, 1963. Lockheed-California Co., Biophys. Res. Div., Burbank, Calif., 1963. 5 p.
174. MILLER, R. A., and CRANFORD, W. A calculational procedure for estimating space radiation exposure during lunar missions. In Protection Against Radiation Hazards in Space: Proceedings of the Symposium held at Gatlinburg, Tenn., Nov. 5-7, 1962. Vol. 2. p. 739-759. Oak Ridge, Tenn., Atomic Energy Commission, Technical Information Extension Div., 1963.
175. MIQUEL, J., and others. Glycogen changes in x-irradiated rat brain. Acta Neuropathologica, No. 2, p. 482-490. 1963.

176. MORE, K. A., and TIFFANY, O. L. Comparison of Monte Carlo and ionization calculations for spacecraft shielding. In Protection Against Radiation Hazards in Space: Proceedings of the Symposium held at Gatlinburg, Tenn., Nov. 5-7, 1962. Vol. 2. p. 682-697. Oak Ridge, Tenn., Atomic Energy Commission, Technical Information Extension Div., 1963.
177. MURPHY, B. L., KITCHING, P., and KNOWLES, H. B. The biological hazards of pi and mu mesons. In Protection Against Radiation Hazards in Space: Proceedings of the Symposium held at Gatlinburg, Tenn., Nov. 5-7, 1962. Vol. 2. p. 866-875. Oak Ridge, Tenn., Atomic Energy Commission, Technical Information Extension Div., 1963.
178. MUSACCHIA, X. J. Physiological effects of weightlessness and space radiation on hibernators. Second Semiannual Status Report. St. Louis University, St. Louis, Mo., June 1963. 5 p.
179. MUSACCHIA, X. J., JELLINEK, M., and COOPER, T. H. Effects of x-irradiation during hibernation on tissue catecholamine contents. *Experientia* 19(8):418-419. 1963.
180. NESTEROV, V. YE., PISARENKO, N. F., SAVENKO, I. A., and SHAVRIN, P. I. Ionizing radiation at altitudes of 180-340 kilometers and radiological safety during flights of spaceships. In Problems of Space Biology, p. 179-202. Washington, D. C., Joint Publ. Res. Serv., Mar. 27, 1963.
181. NEWELL, H. E. The mission of man in space. In Protection Against Radiation Hazards in Space: Proceedings of the Symposium held at Gatlinburg, Tenn., Nov. 5-7, 1962. Vol. 1. p. vii-xvii. Oak Ridge, Tenn., Atomic Energy Commission, Technical Information Extension Div., 1963.
182. NEWSOM, B. D., and KIMELDORF, D. J. Alterations in physiological accommodation to stress induced by irradiation. *Aerosp. Med.* 34:226-230. Mar. 1963.
183. NICKSON, J. J. Acute effects of radiation exposure in man. In Protection Against Radiation Hazards in Space: Proceedings of the Symposium held at Gatlinburg, Tenn., Nov. 5-7, 1962. Vol. 1. p. 269-274. Oak Ridge, Tenn., Atomic Energy Commission, Technical Information Extension Div., 1963.
184. NORWOOD, J. M. The combination of active and passive shielding. In Protection Against Radiation Hazards in Space: Proceedings of the Symposium held at Gatlinburg, Tenn., Nov. 5-7, 1962. Vol. 2. p. 819-828. Oak Ridge, Tenn., Atomic Energy Commission, Technical Information Extension Div., 1963.
185. PAYNE, R. B. Effects of acute radiation exposure on human performance. In Protection Against Radiation Hazards in Space: Proceedings of the Symposium held at Gatlinburg, Tenn., Nov. 5-7, 1962. Vol. 1. p. 343-374. Oak Ridge, Tenn., Atomic Energy Commission, Technical Information Extension Div., 1963.
186. PICKERING, J. E. Biological effects of whole-body proton irradiation. *Aerosp. Med.* 34(10):942-947. 1963.

187. PICKERING, J. E., and TALBOT, J. M. A reappraisal of the radiation hazards to manned space flight. In Second Manned Space Flight Meeting, p. 120-125. New York, American Institute of Aeronautics and Astronautics, 1963.
188. PIERCE, C. M., comp. The biology of space flight: an annotated bibliography (1958-1962). Lockheed Missiles and Space Co., Sunnyvale, Calif., Apr. 1963. 317 p. Refs.
189. PIERCE, C. M., comp. The effects of radiation and radioisotopes on the life processes. An annotated bibliography. Book 1. Washington, D. C., Atomic Energy Commission, Technical Information Div., Sept. 1963. 744 p. Refs.
190. PIERCE, C. M., comp. The effects of radiation and radioisotopes on the life processes. An annotated bibliography. Book 2. Washington, D. C., Atomic Energy Commission, Technical Information Div., Sept. 1963. 751 p. Refs.
191. POLUBOYARINOVA, Z. I. The effects of unithole on the kidney function of dogs injured by ionizing radiation. In Studies in the Field of Medical Radiology, USSR, p. 32-40. Washington, D. C., Joint Publ. Res. Serv., Sept. 25, 1963.
192. RAPOPORT, I. A., and MILLER, A. V. The mutational activity of antiparticles. In Problems of Space Biology, p. 369-379. Washington, D. C., Joint Publ. Res. Serv., Mar. 27, 1963. 10 Refs.
193. RAPOPORT, I. A., YARMONENKO, S. P., and AVRANINA, G. A. The effect of high energy protons on the rate of occurrence of mutations. In Problems of Space Biology, p. 380-396. Washington, D. C., Joint Publ. Res. Serv., Mar. 27, 1963. 15 Refs.
194. ROSSI, M. Protection against cosmic rays during space flights. [La difesa dai raggi cosmici durante i voli spaziali]. In The Man and Technology in the Nuclear and Space Age, Proceedings of the International Congress, Milan, Italy, Apr. 18-21, 1962. p. 433-440. Rome, Associazione Internazionale Uomo Nello Spazio, 1963. In Italian.
195. ROTH, E. M. Selection of space cabin atmospheres. I. Oxygen toxicity. Washington, D. C., Nat. Aeron. Space Admin., Aug. 1963. 94 p. 177 Refs.
196. RUSSELL, W. L. Genetic hazards of radiation. Proc. Amer. Phil. 107(1):11-17. 1963.
197. SAKSONOV, P. P., ANTIPOV, V. V., SHASHKOV, V. S., RAZGOVOROV, B. L., MURIN, G. F., and MOROZOV, V. S. On the biological effect of high-energy protons. International Astronautical Federation, International Astronautical Congress, 14th, Paris, France, Sept. 25-Oct. 1, 1963, Paper. 1963. 8 p.

198. SCHAEFER, H. J. A note on the influence of shield geometry on air dose and tissue dose from protons within a space vehicle. Naval Sch. Aviat. Med., Pensacola, Fla., Apr. 25, 1963. 18 p. 7 Refs.
199. SCHAEFER, H. J. Depth of penetration of solar protons into the atmosphere and related radiation exposure in supersonic transport. Aerosp. Med. 34(1):1-4. 1963.
200. SCHAEFER, H. J. Energy dissipation characteristics in tissue for proton radiation in space. I. Comparative analysis of the LET spectra of monoenergetic, flare produced, and fission neutron recoil protons. Rept. No. 24. Naval Sch. Aviat. Med., Pensacola, Fla., 1963. 11 p.
201. SCHAEFER, H. J. LET spectrum and RBE of high energy protons. In Protection Against Radiation Hazards in Space: Proceedings of the Symposium held at Gatlinburg, Tenn., Nov. 5-7, 1962. Vol. 1. p. 393-401. Oak Ridge, Tenn., Atomic Energy Commission, Technical Information Extension Div., 1963.
202. SCHAEFER, H. J. Local LET spectra in tissue for solar flare protons in space and for neutron produced recoil protons. International Atomic Energy Agency, Biological Effects of Neutron Irradiations Symposium, Brookhaven National Laboratory, Upton, N. Y., Oct. 7-11, 1963, Paper SM-44/30. 1963. 9 p. 13 Refs.
203. SCHAEFER, H. J. The December 1962 report of the RBE Committee to the ICRP and ICRU in its implications for the assessment of proton radiation exposure in space. Rept. No. 26. Naval Sch. Aviat. Med., Pensacola, Fla., 1963. 13 p.
204. SCHMIDT, I. Solar irradiance up to 100 kilometers and related problems of eye protection. In T. Nomura, ed. International Symposium on Space Technology and Science, Tokyo, Japan, Aug. 27-31, 1962, 4th, Proceedings. p. 112-126. Tokyo, Japan, Japan Publications Trading Co., 1963. 32 Refs.
205. SHAKHOV, A. A., STANKO, S. A., and KHAZANOV, V. S. The space flight significance of photoadaptation and photoreactivation in plant organisms. In Problems of Space Biology, p. 349-363. Washington, D. C., Joint Publ. Res. Serv., Mar. 27, 1963. 23 Refs.
206. SNIPES, W. C., and GORDY, W. Radiation damage to Artemia cysts: effects of water vapor. Science 142:503-504. 1963.
207. SNYDER, W. D. Some data on the relationship of RBE and LET. In Protection Against Radiation Hazards in Space: Proceedings of the Symposium held at Gatlinburg, Tenn., Nov. 5-7, 1962. Vol. 1. p. 402-408. Oak Ridge, Tenn., Atomic Energy Commission, Technical Information Extension Div., 1963.

208. SOKOLOV, YU. L., and GURSKIY, A. V. The problem of experimental study of effect of space radiation conditions on higher plants. In Problems of Space Biology, p. 173-178. Washington, D. C., Joint Publ. Res. Serv., Mar. 27, 1963. 7 Refs.
- 209.. SONDHAUS, C. A. Biological effects of high energy protons. In Protection Against Radiation Hazards in Space: Proceedings of the Symposium held at Gatlinburg, Tenn., Nov. 5-7, 1962. Vol. 1. p. 309-342. Oak Ridge, Tenn., Atomic Energy Commission, Technical Information Extension Div., 1963.
210. SPALDING, J. F., SAYEG, J. A., and JOHNSON, O. S. Dose rate effects on lethality of mice exposed to fissioned neutrons. International Atomic Energy Agency, Biological Effects of Neutron Irradiations Symposium, Brookhaven National Laboratory, Upton, N. Y., Oct. 7-11, 1963. Paper SM-44/13. 1963. 15 p. 14 Refs.
211. STAPLETON, G. E., and BENDER, M. A. The ORNL Space Biology Program. Oak Ridge National Laboratory, Biology Div., Oak Ridge, Tenn., Nov. 8, 1963. 39 p.
212. STARA, J. F., and THOMAS, R. G. The tissue distribution and excretion of cesium-137 following inhalation - preliminary data for rats. Technical Progress Report, Lovelace Foundation for Medical Education and Research, Albuquerque, N. Mex., Apr. 27, 1963. 3727 pg. 37 Refs.
213. STRUGHOLD, H. Space medicine beyond the moon. Tex. State J. Med. 59:1166-1172. Dec. 1963. 17 Refs.
214. STRUGHOLD, H. The ecological profile of Mars: bioastronautical aspects. In G. W. Morgenthaler, ed. Advances in the Astronautical Sciences. Vol. 15. Exploration of Mars; Proceedings of the American Astronautical Society Symposium on the Exploration of Mars, Denver, Colo., June 6-7, 1963. p. 30-44. North Hollywood, Calif., Western Periodicals Co., 1963. 36 Refs.
215. SULLIVAN, A. H., and BAARLI, J. An ionization chamber for the estimation of the biological effectiveness of radiation. European Organization for Nuclear Research, Geneva, Switzerland, May 1, 1963. 19 p. 7 Refs.
216. SWIFT, J. Effects of sterilizing agents on microorganisms. Supplement to Literature Search No. 260. California Institute of Technology, Jet Propulsion Lab., Pasadena, Calif., Mar. 1963. 74 p. Refs.
217. THIESSEN, J. W., and VAN WOERDEN, J. Protection against the biological effects of thermal radiation - a bibliography. Technisch. Documentatie en Informatie Centrum Voor de Krijgsmacht, The Hague, Netherlands, Feb. 1963. 105 p. Refs.
218. TOBIAS, P. R. The effects of radiation on integrated behavior. In N. M. Burn, R. M. Chambers, and E. Hendler, eds. Unusual Environments and Human Behavior - Physiological and Psychological Problems of Man in Space, p. 395-417. New York, MacMillan Co., Free Press of Glencoe, 1963. 32 Refs.

219. TURNER, J. E., FEUERBACHER, J. L., ZERBY, C. D., KINNEY, W. E., NEUFELD, J., SNYDER, W. S., and WOODYARD, R. L. The calculation of radiation dose in tissue from high-energy protons. In Protection Against Radiation Hazards in Space: Proceedings of the Symposium held at Gatlinburg, Tenn., Nov. 5-7, 1962. Vol. 2. p. 619-632. Oak Ridge, Tenn., Atomic Energy Commission, Technical Information Extension Div., 1963.

2 220. VAN CLEAVE, C. D. Irradiation and the nervous system. New York, Rowman and Littlefield, Inc., 1963. 433 p.

221. WILSON, R. K. Shielding problems for manned space missions. IEEE Trans. Nucl. Sci. NS-10:17-23. 1963.

222. WILSON, R. K., and MILLER, R. A. Secondary-particle dose contribution induced by solar proton radiation. In Protection Against Radiation Hazards in Space: Proceedings of the Symposium held at Gatlinburg, Tenn., Nov. 5-7, 1962. Vol. 2. p. 595-607. Oak Ridge, Tenn., Atomic Energy Commission, Technical Information Extension Div., 1963.

223. AFANAS'EV., V. P., KEIRIM-MARKUS, I. B., KOVALEV, YE. YE., KUZNETSOVA, S. S., SAKOVICH, V. A., SMIRENNYI, L. N., SOKOLOVA, I. K., and SYCHROV, M. A. Massive dose radiation of high-energy proton beams in biological experiments on mammals. [Dosnoe pole dlia oblucheniya zhivotnykh protonami vysokikh energi]. Radiobiologiya 4:775-781. 1964. 18 Refs. In Russian.
224. ANDREWS, G. A., and SMYSER, M. Hematologic responses to total-body irradiation in the human being. In Oak Ridge Institute of Nuclear Studies, Medical Division Research Report, Year Ending 31 Dec. 1964. p. 13-16. Oak Ridge, Tenn., Oak Ridge Institute of Nuclear Studies, Inc., Medical Div., 1964.
225. ANTIPOV, V. V., VYSOTSKIY, V. G., DAVYDOV, B. I., DOBROV, N. N., MOROZOV, V. S., and others. Some problems in ensuring the radiation safety of space flights. In Aviation and Space Medicine, p. 18-20. Washington, D. C., Nat. Aeron. Space Admin., Dec. 1964.
226. AUXIER, T. A. A theoretical study of space equivalent thermal conditions and their applicability. Rept. No. AMRL-TDR-64-20. USAF Systems Command, Aeromed. Res. Lab., Wright-Patterson AFB, Ohio, 1964. 104 p.
227. AZHIPA, YA. I., and FILIASHINA, G. A. The role of the nervous system in the reaction of kidneys to small internal doses of ionizing radiation. [O roli nervnoi sistemy v reaktsiy pochk na deistvie mal'kh doz vnutrennego ioniziruyushchego oblucheniya]. In A. M. Aleksanian, ed. Problems of the Physiology of the Autonomic Nervous System and of the Cerebellum. p. 28-36. Erevan, Izdatel'stvo Akademii Nauk Armianskoi SSR, 1964. 26 Refs. In Russian.
228. BALLINGER, E. R. New information on solar flares and space radiation. In Lectures in Aerospace Medicine, 3-7, Feb. 1964. p. 42-49. Sch. Aerosp. Med., Brooks AFB, Tex., 1964.
229. BENJAMIN, F. B. Effect of oxygen on radiation resistance of mice. Aerosp. Med. 35:1147-1149. Dec. 1964. 12 Refs.
230. BOCHVAR, I. A., VASILYEVA, A. A., KEIRIM-MARKUS, I. B., PROSINA, T. P., SERGEEVA, N. A., and others. Cosmic radiation tissue dose received by V. F. Bykovskiy and V. V. Nikolaeva-Tereshkova during their joint flight. In Cosmic Research, Vol. 2, No. 2, p. 208-211. Air Force Systems Command, Foreign Technol. Div., Wright-Patterson AFB, Ohio, June 8, 1964. Refs.
231. BRENNAN, J. T. Closing remarks for session on dose distribution, partial-body exposure and abscopal effects. Ann. N.Y. Acad. Sci. 114(1):339-340. 1964.
232. BYCHROVSKAYA, I. B., and OCHINSKAYA, G. K. Study of the "oxygen effect" at various radiation dose rates. In Radiobiology, p. 85-90. Washington, D. C., Atomic Energy Commission, Technical Information Div., 1964. Refs.

233. CLARK, C. High energy radiations (review with 55 references). In J. D. Hardy, ed. Physiological Problems in Space Exploration, p. 47-99. Springfield, Ill., Charles C. Thomas, 1964.
234. CLEMEDSON, C.-J. Integrated human research and aerospace medicine. *Aerosp. Med.* 35:511-518. June 1964.
235. COSPAR. Investigations of the upper atmosphere and outer space carried out in the USSR in 1963. COSPAR, Meeting, 7th, and International Space Science Symposium, 5th, Florence, Italy, May 8-20, 1964, Paper. 1964. 89 p.
236. COSPAR. National report of France. [Rapport national de la France]. COSPAR, Meeting, 7th, and International Space Science Symposium, 5th, Florence, Italy, May 8-20, 1964, Paper. 1964. 39 p. In French.
237. COSPAR. National report on space activities in Italy. COSPAR, Meeting, 7th, and International Space Science Symposium, 5th, Florence, Italy, May 8-20, 1964, Paper. 1964. 13 p.
238. DANCE, W. E., EDENS, D. L., FARMER, B. J., and JOHNSON, J. H. Proton penetration of space suit materials. *Health Phys.* 10(11): 809-816. 1964.
239. DE ESTABLE, R. F., ESTABLE-PUIG, J. F., and HAYMAKER, W. Electron microscopy of rat cerebellar cortex following exposure to ionizing radiation. *Nat. Aeron. Space Admin., Ames Res. Cent., Moffett Field, Calif.*, 1964. 26 p. Refs.
240. DELAHAYE, R. P., and TABUSSE, E. Radiobiological problems posed by space travel. [Problemes radiobiologiques poses par les voyages spatiaux]. *Forces Aeriennes Francaises*, p. 481-492. Oct. 1964. In French.
241. DELONE, N. L., POPOVICH, P. R., ANTIPOV, V. V., and others. Impairment of the mechanism of mitosis in microspores after flight on Vostok 3 and Vostok 4. In *Aviation and Space Medicine*, p. 126-130. Washington, D. C., *Nat. Aeron. Space Admin.*, Dec. 1964.
242. DEMIN, YU. S. The influence of x-rays and vibration on cell nuclei of the bone marrow of mammals. [Deistvie vibratsiy i rentgenovykh-luchey na iadro kletok kostnogo mozga mlekopitayushchikh]. *Radiobiologiya* 4:563-568. 1964. 24 Refs. In Russian.
243. DUBININ, N. P. Studies in molecular genetics and the effect of radiation on heredity. Washington, D. C., *Joint Publ. Res. Serv.*, Jan. 2, 1964. 26 p. Transl. from the book, *Molekulyarnaya Genetika i Deystviye na Nasledstvennost*, p. 3-12 and 236-239. Moscow, 1963.
244. ESTABLE-PUIG, J. F., DE ESTABLE, R. F., TOBIAS, C. A., and HAYMAKER, W. Degeneration and regeneration of myelinated fibers in the cerebral and cerebellar cortex following damage from ionizing particle radiation. *Acta Neuropathol.* 4:175-190. 1964. 18 Refs.



245. EUGSTER, J. G. Subradiation experiments concerning the concept of the natural radiation environment. *Aerosp. Med.* 35:524-526. June 1964. 7 Refs.
246. EVVARD, J. C. Nature of the space environment. *National Aeronautics and Space Administration, Lewis Res. Cent., Cleveland, Ohio*, 1964. 39 p. Refs.
247. FEDOROVA, R. I. Effects of ultraviolet radiation on microorganisms as a principal extremal factor of space environment. *In* M. Florkin and A. Dollfus, eds. *Life Sciences and Space Research II; International Space Science Symposium, 4th, Warsaw, Poland, June 3-12, 1963.* p. 305-310. Amsterdam, North-Holland Publishing Co., 1964.
248. FEDOROVA, T. A., TUTOCHKINA, L. T., USPENSKAYA, M. S., SKURIKHINA, M. M., and FEDOROV, YE. A. Some metabolic indexes in the astronauts: Yu. A. Gagarin, G. S. Titov, A. G. Nikolayev and P. R. Popovich. *In* *Aviation and Space Medicine*, p. 395-398. Washington, D. C., Nat. Aeron. Space Admin., Dec. 1964.
249. FISCHER, R. A. Life support systems for lunar base operations. *In* C. T. Leondes and R. W. Vance, eds. *Lunar Missions and Exploration*, p. 452-497. New York, John Wiley & Sons, Inc., 1964. 15 Refs..
250. FOELSCH, T. The ionizing radiations in supersonic transport flights. *National Aeronautics and Space Administration, Langley Res. Cent., Langley Station, Va.*, 1964. 23 p. Refs.
251. GAMBINO, J. J., BENNETT, L. R., BILLINGS, M. S., and LAMSON, B. G. Biological effect of stress following ionizing radiation. *Aerosp. Med.* 35:220-224. Mar. 1964. 41 Refs.
252. GAMBINO, J. J., and LINDBERG, R. G. Investigation of *Perognathus* as an experimental organism for research in space biology. *Second Quarterly Status Report, Apr. 1-July 31, 1964.* Northrop Corp., Hawthorne, Calif., 1964. 25 p. Refs.
253. GENERALES, C. D. J. The dynamics of cosmic medicine. *N. Y. State J. Med.* 64:225-235. Jan. 15, 1964. 4 Refs.
254. GINSBURG, T. Technical and biological problems of manned space flight. [Technische und biologische probleme des bemannten weltraumfluges]. *Naturwiss. Rundsch.* 17:175-182. May 1964. In German.
255. GLASS, R. A., and GAINES, E. E. Satellite measurements of space radiation doses. (Abstr.) *Radiat. Res.* 120(1):189-190. 1964.
256. GOL'DSHTEIN, M. M. Influence of ionizing radiation on the sub-microscopic structures of the striated muscles. *In* *Radiobiology*, p. 30-38. Washington, D. C., Atomic Energy Commission, Technical Information Div., 1964. Refs.

257. GOODEN, B. A. Physiological responses of man in orbit. Spaceflight 6:63-66. Mar. 1964. 19 Refs.
258. GRAUL, E. H. On the problem of ionizing radiation stress in manned space flight as well as supersonic and hypersonic commercial flight. Part 1. [Zur frage der belastung durch ionisierende strahlung beim bemannten raumflug sowie beim ~~uberschall~~hyperschallverkehrsflug. 1. Mitteilung]. Biophysik 1:260-281. 1964. 26 Refs. In German.
259. GRAUL, E. H. The radiobiological-effectiveness problem for acute and chronical exposure in the radiobiological research in space medicine. [Das problem des RBW bei akuter und chronischer strahlenbelastung in der radiobiologischen forschung der raumfahrtmedizin]. Raumfahrtforschung 8:1-9. Jan.-Mar. 1964. In German.
260. GRAUL, E. H. Space medicine - analysis and possibilities. [Raumfahrtmedizin - begriff und moglichkeiten]. Weltraumfahrt Raketentech. 15:68-74. May-June 1964. In German.
261. HAZEL, J. Radiation hazards and manned space flight. Aerosp. Med. 35:436-439. May 1964. 14 Refs.
262. HELVEY, W., MARTELL, C., PETERS, J., ROSENTHAL, G., BENJAMIN, F., and others. Biomedical and human factors requirements for a manned earth orbiting station. National Aeronautics and Space Administration, Washington, D. C., Jan. 3, 1964. 442 p. Refs.
263. HUDDLESTON, H. F. Psychological research in space flight. Spaceflight 6:189-192. Nov. 1964. 23 Refs.
264. ISAKOV, P. Life on a satellite. In Stations in Space, p. 12-22. Wright-Patterson AFB, Ohio, Air Force Systems Command, Foreign Technol. Div., Feb. 10, 1964.
265. KOROBKOV, A. V. Development and preservation of a high level of motor function as a problem in the preparation and execution of extended space flights. In Aviation and Space Medicine, p. 245-247. Washington, D. C., Nat. Aeron. Space Admin., Dec. 1964.
266. KUZIN, A. M. Some problems of the theory of the biological action of fast neutrons. In Radiobiology, p. 23-29. Washington, D. C., Atomic Energy Commission, Technical Information Div., 1964. Refs.
267. KUZMIN, A. D. On the ionospheric model of Venus. In M. Florkin and A. Dollfus, eds. Life Sciences and Space Research II; International Space Science Symposium, 4th, Warsaw, Poland, June 3-12, 1963. p. 211-221. Amsterdam, North-Holland Publishing Co., 1964.
268. LAZARUS, H. D. Effects of radiation on the mammalian eye. A literature survey. Oak Ridge National Laboratory, Oak Ridge, Tenn., July 1964. 30 p.

269. LEAVITT, W. What is so rare as a solar flare? Report from USAF School of Aerospace Medicine on what experts think on solar flares, extended weightlessness, and human vision in space). Air Force and Space Digest 47:74-75. Mar. 1964.
270. LEBEDINSKIY, A. V., LEVINSKIY, S. V., and NEFEDOV, YU. G. General principles concerning the reaction of the organism to the complex environmental factors existing in spacecraft cabins. [Obshchiye zakonomernosti reaktsiy organizma cheloveka na kompleksnoye vozdeystviye faktorov sredy, kharakternykh dlya kabiny kosmicheskikh letatel'nykh apparatov]. Washington, D. C., Nat. Aeron. Space Admin., Dec. 1964. 15 p.
271. LE GALLEY, D. P., and MCKEE, J. W., eds. Space exploration. New York, McGraw-Hill, Book Co., 1964. 467 p., 12 illus.
272. LIBBER, L. M. Basic research as related to life support systems. Northeastern States Navy Research and Development Clinic, Philadelphia, Penn., Nov. 18-20, 1964, Paper No. 56. 1964. 15 p.
273. LIBRARY OF CONGRESS, Aerospace Technology Division, Washington, D. C. Soviet literature on life support systems. Part A. Biosciences. Compilation of abstracts. Sept. 1, 1964. 29 p. Refs.
274. LUK'YANOVA, L. D. The vibration and radiation effect on the acidifying processes in the brain tissues of rats. In Aviation and Space Medicine, p. 296-297. Washington, D. C., Nat. Aeron. Space Admin., Dec. 1964.
275. LUSHBAUGH, C. C., HOFSTRA, R., ROTH, R. E., and ANDREWS, G. A. Radiosensitivity in man: a study based on therapeutic and accidental exposure. In Oak Ridge Institute of Nuclear Studies, Medical Division Research Report, Year Ending Dec. 31, 1964. p. 128-131. Oak Ridge, Tenn., Oak Ridge Institute of Nuclear Studies, Medical Div., 1964.
276. MARKELOVA, L., DMITRIYEV, D., and BERNASKONI, L. A human in a spaceship. Washington, D. C., Joint Publ. Res. Serv., Dec. 16, 1964. 10 p. Transl. from Sov. Litva (Vilnyus), Nov. 4, 1964, p. 3-4.
277. MATUSEVICH, YE. S., and TSYPIN, S. G. Problems in protecting human beings from radiation in space. Washington, D. C., Joint Publ. Res. Serv., Feb. 19, 1964. 13 p. Refs. Transl. from At. Energ. (Moscow) 15(6):499-504. Dec. 1963.
278. MAZZELLA, G. The effect of hypoxia on the taking of a second graft of homologous bone marrow in previously irradiated and grafted mice. International Congress on Aeronautic and Space Medicine, 13th, Dublin, Ireland, Sept. 14-18, 1964, Paper. 1964. 9 p. 9 Refs.
279. MONTGOMERY, P. O'B., ROSENBLUM, E., and STAPP, B. Gravity, radiation and growth. Aerosp. Med. 35:731-733. Aug. 1964.

280. NESTERENKO, V. S. The influence of ionizing radiation and coriolis acceleration on the functional state of the vestibular analyzer. [Deistvie ioniziruyushchego izlucheniya i uskoreniya koriolisa na funktsional'noe sostoyanie vestibuliarnogo analizatora]. Radiobiologiya i biologiya 4:643. 1964. In Russian.
281. PASINETTI, A., and PASINETTI, L. E. The problem of ionizing radiations in space flight. In N. Boneff and I. Hersey, eds. International Astronautical Congress, 13th, Varna, Bulgaria, Sept. 1962, Proceedings, Vol. 1. p. 271-291. Vienna, Springer-Verlag, 1964. 40 Refs.
282. PICKERING, J. E. Space radiobiology training and operations - a concept. Southwest Research Institute and USAF, International Symposium on Bioastronautics and the Exploration of Space, 3rd, San Antonio, Tex., Nov. 16-18, 1964, Paper. 1964. 20 p.
283. POLLARD, E. C. Ionizing radiation - effect on genetic transcription. Science 146:927-929. Nov. 13, 1964. 15 Refs.
284. PRAVDINA, K. I. Spectrophotometric evaluation of radiation damage of hemoglobin. In Radiobiology, p. 11-22. Washington, D. C., Atomic Energy Commission, Technical Information Div., 1964. Refs.
285. REZONTOV, V. A. Evaluation of the reparation of radiation injuries according to an investigation of the state of myelopoiesis of dogs under repeated actions of ionizing radiation. In Radiobiology, p. 149-156. Washington, D. C., Atomic Energy Commission, Technical Information Div., 1964. Refs.
286. ROBINSON, N. Radiation load by direct sun radiation and scattered sky radiation on instruments imitating the physiological behaviour of human bodies. In Environmental Physiology and Psychology in Arid Conditions, p. 315-323. Paris, France, UNESCO, 1964. 8 Refs.
287. SAKSONOV, P. P., ANTUNOV, V. V., and DOBROV, N. N. Some results and problems in the field of space radiobiology. Air Force Systems Command, Foreign Technol. Div., Wright-Patterson AFB, Ohio, Mar. 23, 1964. 14 p. Transl. from Vestn. Akad. Med. Nauk SSSR (Moscow) no. 8, p. 13-20. 1963.
288. SAUERLAND, E. K., and GORDEE, R. S. Investigation of the effects of ionizing radiation on the central nervous system in vivo and in vitro. Lockheed-California Co., Physical and Life Sciences Lab., Burbank, Calif., July 1964. 84 p. Refs.
289. SAVENKO, I. A., PISARENKO, N. F., SHAVRIN, P. I., and NESTEROV, V. YE. Measurement of the total radiation dose on Vostok 5 and 6. In Cosmic Research, p. 236-239. Air Force Systems Command, Foreign Technol. Div., Wright-Patterson AFB, Ohio, Apr. 27, 1964. Refs.

290. SAVENKO, I. A., SHAVRIN, P. I., PISARENKO, N. F., NESTEROV, V. YE., TEL'TSOV, M. V., and YEROFEYEVA, V. N. Measurement of soft radiation in the equatorial latitude from the "Kosmos-4" satellite. Kosm. Issled. 2(1):150-153. 1964.
291. SCHAEFER, H. J. Linear energy transfer spectrum of proton exposure on Mercury Mission MA-9. Report No. 28. Naval Sch. Aviat. Med., Pensacola, Fla., July 14, 1964. 16 p. Refs.
292. SCHAEFER, H. J. Radiation monitoring on Project Mercury: results and implications. Aerosp. Med. 35:829-833. Sept. 1964.
293. SCHAEFER, H. J. The radiation field inside space vehicles. Aerosp. Med. 35:104-110. Feb. 1964. 7 Refs.
294. SCHAEFER, G. Chemical protection from radiation in supersonic transports and manned space flights. International Congress on Aeronautic and Space Medicine, 13th, Dublin, Ireland, Sept. 14-18, 1964, Paper. 1964. 6 p.
295. SCHWAN, H. P. Non-thermal effects of alternating electrical fields on biological structures. Final Report, 1 Jan. 1963-29 Feb. 1964. University of Pennsylvania, Philadelphia, Penna., Apr. 30, 1964. 13 p. Refs.
296. SEVAN'KAYEV, A. V. Functional state of the vestibular analyzer during the first few hours following irradiation with different doses. In Aviation and Space Medicine, p. 373-375. Washington, D. C., Nat. Aeron. Space Admin., Dec. 1964. Ref.
297. SHKURDODA, V. A. Effect of brief physical training on the survival of white rats kept under conditions of prolonged hypodynamia and isolation. In Aviation and Space Medicine, p. 427-429. Washington, D. C., Nat. Aeron. Space Admin., Dec. 1964.
298. SIROTININ, N. N. The role of reduced reactivity of the organism in resistance to extreme influences (acceleration, radiation). In Aviation and Space Medicine, p. 384-386. Washington, D. C., Nat. Aeron. Space Admin., Dec. 1964.
299. SISAQYAN, N. M., PARIN, V. V., ANTIPOV, V. V., DOBROV, N. N., and SAKSONOV, P. P. Certain results of and long-term prospects for the development of radiobiological research in space. In Biological Studies under Conditions of Space Flight and Weightlessness, p. 1-15. Washington, D. C., Joint Publ. Res. Serv., Aug. 11, 1964. Refs.
300. SISAQYAN, N. M., PARIN, V. V., ANTIPOV, V. V., DOBROV, N. N., and SAKSONOV, P. P. Present achievements and future plans of radiobiological research in space. Izv. Akad. Nauk SSSR, Ser. Biol., no. 3, p. 341-351. 1964.
301. SVESHNIKOV, A. A., and SEVAN'KAYEV, A. V. Change in the sensitivity and reactivity of the vestibular analyzer under the influence of ionizing radiation. In Problems of Space Biology, p. 391-403. Washington, D. C., Joint Publ. Res. Serv., June 29, 1964. Refs.

302. TAKETA, S. T. Delayed radiation effects in abdomen-irradiated rats. Ann. N. Y. Acad. Sci. 114:328-334. Mar. 31, 1964.
303. TRIBUKAIT, B., and FORSSBERG, A. Changes in the radiation-sensitivity of the mouse following previous maintenance in a state of hypoxia. [Aenderung der Strahlenempfindlichkeit der Maus nach vorubergehenden Aufenthalt in Hypoxie]. Naturwissenschaften 51(1):12-13. 1964.
304. TSEITLIN, P. I., YASKEVICH, G. P., and RYABCHENKO, N. I. Effects of ionizing radiation on the system of hydrogen bonds of DNA macromolecules. In Radiobiology, p. 1-10. Washington, D. C., Atomic Energy Commission, Technical Information Div., 1964. Refs.
305. VAN HOEK, R., and HANSEN, C. L. JR. Clinical problems in aviation medicine. Radiation recovery in man: a clinical evaluation of the problem. Aerosp. Med. 35(4):383-385. 1964.
306. VOLYNKIN, YU. M., PARIN, V. V., ANTIPOV, V. V., GUDA, V. A., DOBROV, N. N., NIKITIN, M. D., and SAKSONOV, P. P. Protection against radiation dangers during flights by Soviet astronauts on the Vostok spacecraft. [Obespecheniye radiatsionnoy bezopasnosti pri poletakh sovetskikh kosmonavtov na korablyakh "Vostok"]. Radiobiologiya 4(3):344-348. 1964.
307. WARD, H. L., and BOST, W. E. Subject index to effects of radiation on the mammalian eye - a literature survey. Oak Ridge, Tenn., Atomic Energy Commission, Technical Information Extension Div., July 1964. 18 p.
308. WARREN, C. S., and GILL, W. L. Radiation dosimetry aboard the spacecraft of the eighth Mercury-Atlas Mission (MA-8). Washington, D. C., Nat. Aeron. Space Admin., Aug. 1964. 22 p. Refs.
309. WEBB, P., Thermal balance, heat tolerance, and protection. In K. E. Schaefer, ed. Bioastronautics, p. 111-128. New York, MacMillan Co., 1964. 39 Refs.
310. WESTHOFF, D. D., and MUSACCHIA, X. J. Intestinal absorption of sugar and effects of Co<sup>60</sup> irradiation in ground squirrel, Citellus tridecemlineatus. (Abstr.) Physiologist 7(3):284. 1964.
311. WHITE, S. C., and BERRY, C. A. Resume of present knowledge of man's ability to meet the space environment. Aerosp. Med. 35:43-48. Jan. 1964.
312. WOODWARD, A. A. JR., and HICKS, S. A. High temperature-high humidity environments. In Institute of Environmental Sciences, Annual Technical Meeting, Philadelphia, Penna., Apr. 13-15, 1964, Proceedings, p. 195-203. Mt. Prospect, Ill., Institute of Environmental Sciences, 1964. 14 Refs.

313. YAGODA, H. Interaction of cosmic and solar flare radiations with the Martian atmosphere and their biological implications. In M. Florkin and A. Dollfus, eds. Life Sciences and Space Research II, International Space Science Symposium, 4th, Warsaw, Poland, June 3-12, 1964. p. 101-104. Amsterdam, North-Holland Publishing Co., 1964.
314. YARMONENKO, S. P., KURLYANDSKAYA, E. B., AVRUNINA, G. A., GAYDOVA, YE. S., GOVORUN, R. D., and others. Radiation reactions and chemical protection of animals exposed to high-energy protons. In Aviation and Space Medicine, p. 442-445. Washington, D. C., Nat. Aeron. Space Admin., Dec. 1964.
315. ZHUKOV, VEREZHNIKOV, N. N., YAZDOVSKIY, V. I., MAYSKIY, I. N., and others. Microbiological and cytological studies in the conquest of space. In Problems of Space Biology, p. 198-205. Washington, D. C., Joint Publ. Res. Serv., June 29, 1964. Refs.

316. ALEKSANDROV, S. N. Pathogenesis of remote consequences of radiation. In Vestnik of the USSR Academy of Medical Sciences, p. 12-15. Washington, D. C., Joint Publ. Res. Serv., Dec. 7, 1965.
317. ALEXANDER, D. A., and BACQ, Z. M. The nature of initial radiation damage on a subcellular level. In Primary and Initial Processes in the Biological Effects of Radiation, p. 8-29. Air Force Systems Command, Foreign Technol. Div., Wright-Patterson AFB, Ohio, Jan. 29, 1965. 29 Refs.
318. ANTIPOV, V. V. Possibility of using tissue hemolysins to indicate the efficacy of radioprotective preparations contraindicated. Washington, D. C., Joint Publ. Res. Serv., Mar. 3, 1965. 13 p. Refs. Transl. from Radiobiologiya (Moscow) 1(1):86-92. 1961.
319. ANTIPOV, V. V., NIKITIN, M. D., and SAKSONOV, P. P. Along the route from the earth to the moon - a biological evaluation of danger from radiation during space flights. In Miscellaneous Articles in Priroda (Nature, no. 4, 1965) on Space Flight and Physiology and Medical Development, p. 13-24. Washington, D. C., Joint Publ. Res. Serv., 1965. Ref.
320. APANASENKO, Z. I. Combined effects of vibration and acute irradiation on vestibular function in guinea pigs. In Effects of Ionizing Radiation and of Dynamic Factors on the Functions of the Central Nervous System - Problems of Space Physiology, p. 79-87. Washington, D. C., Nat. Aeron. Space Admin., Aug. 1965.
321. ARSEN'EVA, M. A., BELYAEVA, L. A., DEMIN, YU. S., POKROVSKAYA, G. L., GOLOVKINA, A. V., and GAVRILINA, L. I. Effect of space flight factors on the genetic system of mammals. [Vliyanie nekotorykh faktorov kosmicheskogo poleta na nasledstvennyye struktury mlekoptáyushchikh]. Kosm. Issled. 3:796-807. Sept.-Oct. 1965. 8 Refs.
322. ARSEN'EVA, M. A., BELYAEVA, L. A., and GOLOVKINA, A. V. Effect of the combined action of accelerations, vibration, and radiation on the nuclei of bone-marrow cells in mice. [Vliyanie kombinirovannogo deistviya uskoreniy, vibratsiy i radiatsiy na yadra kletok kostnogo mozga myshei]. In N. M. Sisakian, ed. Problems of Space Biology, Vol. 4. p. 373-390. Moscow, Izdatel'stvo Nauka, 1965. 15 Refs. In Russian.
323. BACQ, Z. M. Chemical protection against ionizing radiation. Springfield, Ill., Charles C. Thomas, 1965. 328 p.
324. BACQ, Z. M., and ALEXANDER, P. Mechanism of chemical radiation protection. In Primary and Initial Processes in the Biological Effects of Radiation, p. 289-363. Air Force Systems Command, Foreign Technol. Div., Wright-Patterson AFB, Ohio, Jan. 29, 1965. Refs.



325. BACQ, Z. M., and BEAUMARIAGE, M. L. Radioprotective action of cysteamine and cystamine in mice as function of the time separating the injection of the protective agent and before irradiation by x-rays. [Action radioprotectrice de la cysteamine et de la cystamine chez la souris en fonction du temps séparant l'injection du protecteur du début de l'irradiation par rayons x]. Arch. Int. Pharmacodyn. Ther. 153:457-459. Feb. 1965. 6 Refs. In French.
326. BAILY, N. A. Radiation dosimetry aboard manned space vehicles. In American Institute of Aeronautics and Astronautics, Manned Space Flight Meeting, 4th, St. Louis, Mo., Oct. 11-13, 1965, Technical Papers. p. 318-325. New York, American Institute of Aeronautics and Astronautics, 1965. 14 Refs.
327. BARAKINA, N. F., and YANUSHEVSKAYA, M. I. The long range effect of ionizing radiation on the chromosomes of bone marrow cells. [Distantionnoe vliyanie ioniziruyushchei radiatsiy na khromosomy kletok kostnogo mozga]. Dokl. Akad. Nauk SSSR 165:427-430. Nov. 11, 1965. 22 Refs. In Russian.
328. BARENDSEN, G. V. Impairment of the reproductive capacity of human cells in tissue cultures by the effect of ionizing radiation with different linear energy loss. In Primary and Initial Processes in the Biological Effects of Radiation, p. 224-240. Air Force Systems Command, Foreign Technol. Div., Wright-Patterson AFB, Ohio, Jan. 29, 1965. Refs.
329. BARONENKO, V. A. The influence of insolation of the collar zone on conditioned reflex activity and arterial pressure of animals. In Soviet Research on Insolation, p. 1-8. Washington, D. C., Joint Publ. Res. Serv., June 9, 1965. Refs.
330. BARSUKOV, V. S., MALINOVSKIY, O. V., and MITIUSHOVA, N. M. Importance of the process of post-radiation restitution of genetic structures for the radiosensitivity of cells. II. Radiosensitivity of yeast cells with various degrees of chromosome replication. [O znachenii protsessy postradiatsionnogo vosstanovleniya geneticheskikh struktur dlya radiochuvstvitel'nosti kletok. II. Radiochuvstvitel'nost' drozhzhevykh kletok raznoi ploïdnosti]. In N. M. Sisakian, ed. Problems of Space Biology. Vol. 4. p. 461-468. Moscow, Izdatel'stvo Nauka, 1965. 11 Refs. In Russian.
331. BARSUKOV, V. S., MALINOVSKIY, O. V., and MITIUSHOVA, N. M. Value of the process of post-radiation restitution of genetic structures for the radiosensitivity of cells. I. Quantitative regularities in post-radiation restitution of yeast cells. [O znachenii protsessy postradiatsionnogo vosstanovleniya geneticheskikh struktur dlya radiochuvstvitel'nosti kletok. I. Kolichestvennye zakonomernosti post-postradiatsionnogo vosstanovleniya drozhzhevykh kletok]. In N. M. Sisakian, ed. Problems of Space Biology. Vol. 4. p. 451-460. Moscow, Izdatel'stvo Nauka, 1965. 13 Refs. In Russian.
332. BAZYKIN, V. Radiation hazards in outer space. Aerosp. Med. 36: 1194-1195. Dec. 1965.

333. BEEVER, E. R., and RUSLING, D. H. The importance of space radiation shielding weight. In A. Reetz, ed. Second Symposium on Protection against Radiations in Space, p. 407-414. Washington, D. C., Nat. Aeron. Space Admin., 1965. Refs.
334. BENDER, M. A., GOOCH, P. C., and KONDO, S. Experiment S-4, zéro g and radiation on blood during Gemini III. In Manned Space Flight Experiments Symposium, Gemini Missions III and IV, p. 217-236. Washington, D. C., Nat. Aeron. Space Admin., 1965.
335. BILLINGHAM, J. Status report on the space radiation effects on the Apollo Mission. A. Apollo dose limits. In A. Reetz, ed. Second Symposium on Protection against Radiations in Space, p. 139-141. Washington, D. C., Nat. Aeron. Space Admin., 1965. Refs.
336. BULGAK, V. I. Daily rhythm of mitotic activity in the regenerating liver during acute radiation sickness. In Transl. from Byull. Eksp. Biol. Med. 59(1):27-32. Washington, D. C., Joint Publ. Res. Serv., Mar. 23, 1965. Refs.
337. BURRELL, M. O. The calculation of proton penetration and dose rates. In A. Reetz, ed. Second Symposium on Protection against Radiations in Space, p. 493-505. Washington, D. C., Nat. Aeron. Space Admin., 1965. Refs.
338. CASEY, H. W. The influence of chronic acceleration on the effects of whole-body irradiation on rats. University of California, Davis, Calif., 1965. 78 p. Refs.
339. CHICAGO, UNIVERSITY OF. Research on certain biological and medical aspects of atomic energy. Quarterly Progress Report. University of Chicago, Radiation Lab., Chicago, Ill., Apr. 15, 1965. 105 p. Refs.
340. CLARK, B. C., and ADAMS, D. E. Experimental measurements of the radiation hazards associated with manned space flights. In M. Florkin, ed. Life Sciences and Space Research III; International Space Science Symposium, 5th, Florence, Italy, May 12-14, 1964. p. 29-47. Amsterdam, North-Holland Publishing Co., 1965. 19 Refs.
341. CONARD, R. A. Hematological effects of space radiation. Brookhaven National Laboratory, Upton, N. Y., 1965. 31 p. Refs.
342. CURTIS, S. B., DYE, D. L., and SHELDON, W. R. Fractional cell lethality approach to space radiation hazards. In A. Reetz, ed. Second Symposium on Protection against Radiations in Space, p. 219-223. Washington, D. C., Nat. Aeron. Space Admin., 1965. Refs.
343. DALE, E. B., and others. Space environment analyses, human performance studies, and gravitational field effects on enzymatic reactions. Kansas State University, Dept. of Physics, Manhattan, Kans., 1965. 45 p. Refs.

344. DALRYMPLE, G. V., and LINDSAY, I. R. Protons and space travel: an introduction. Rept. No. SAM-TR-65-254. Sch. Aerosp. Med., Brooks AFB, Tex., July 12, 1965. 11 p.
345. DALRYMPLE, G. V., LINDSAY, I. R., GHIDONI, J. J., and others. Some effects of whole-body 32 mev proton irradiation on primates. The radiations of space II, June 1964-Mar. 1, 1965. Sch. Aerosp. Med., Brooks AFB, Tex., June 1965. 38 p. Refs.
346. DAVYDOV, B. I., ANTIPOV, V. V., KONNOVA, N. I., and SAKSONOV, P. P. Radiobiological effects in animals pre-exposed to the effect of acceleration. [Radiobiologicheskie effekty u zhivotnykh posle predvaritel'nogo vozdeistviya uskoreniya]. Kosm. Issled. 3: 789-795. Sept.-Oct. 1965. 14 Refs. In Russian.
347. DAVYDOV, B. I., ANTIPOV, V. V., and SAKSONOV, P. P. Response of the irradiated organism to critical-value acceleration. [Reaktivnost' obluchennogo organizma pri deistviy kriticheskogo po velichine uskoreniya]. Kosm. Issled. 3:159-166. Jan.-Feb. 1965. 19 Refs. In Russian.
348. DAVYDOV, B. I., ANTIPOV, V. V., and SAKSONOV, P. P. Reaction of irradiated organism when affected by acceleration of critical magnitude. In Cosmic Research, Vol. 3, No. 2, p. 256-268. Air Force Systems Command, Foreign Technol. Div., Wright-Patterson AFB, Ohio, Apr. 1, 1965. Refs.
349. DEMIN, N. N., and BLOKHINA, B. D. Radiative destruction of lipids in the cell microstructures. In Primary and Initial Processes in the Biological Effects of Radiation, p. 170-184. Air Force Systems Command, Foreign Technol. Div., Wright-Patterson AFB, Ohio, Jan. 29, 1965. Refs.
350. DYE, D. L., and WILKINSON, M. Radiation hazards in space. Science 147:19-25. Jan. 1, 1965.
351. FLORKIN, M., ed. Life sciences and space research, Vol. 3, International Space Science Symposium, 5th, Florence, Italy, May 12-16, 1964. Amsterdam, North-Holland Publishing Co., 1965. 258 p.
352. FRANK, G. M., LIVSHITS, N. N., ARSEN'EVA, M. A., APANASENKO, Z. I., BELYAEVA, L. A., and others. Combined effect of space-flight factors on certain functions of an organism. [Kombinirovannoe vozdeystviye faktorov kosmicheskogo poleta nekotoryye funktsiy organizma]. University of California at Berkeley, Lawrence Radiation Lab., Berkeley, Calif., 1965. 82 p. Refs. Transl. from Acad. Med. Sci. USSR Preprint No. 17.
353. GAIDAMAKIN, N. A., PETRUKHIN, V. G., SHASHKOV, V. S., ANTIPOV, V. V., and SAKSONOV, P. P. Morphological changes in the hemopoietic organs of mice after irradiation with high energy protons. [Morfologicheskie izmeneniya v krovotvornykh organakh myshei posle obлучeniya protonami vysokikh energiy]. In N. M. Sisakian, ed. Problems of Space Biology, Vol. 4. p. 430-436. Moscow, Izdatel'stvo Nauka, 1965. 17 Refs. In Russian.

354. GASTEVA, S. V., IVANOV, K. P., and CHETVERIKOV, D. A. Resistance to acute oxygen deficiency of rats with radiation sickness. [Ustoichivost' kry's k ostroi kislorodnoi nedostatocnosti pri luchevoi bolezni]. In N. M. Sisakian, ed. Problems of Space Biology. Vol. 4. p. 437-444. Moscow, Izdatel'stvo Nauka, 1965. 16 Refs. In Russian.
355. GAZENKO, O. G. Gzenko discusses Soviet space medicine. Aviat. Week Space Technol. 82:40,41,43,45. June 7, 1965.
356. GILEVA, E. A., TIMOFEEVA, N. A., TIMOFEEV-RESOVSKIY, N. V. Influence of CO<sup>60</sup> gamma radiation on the growth of Chlorella cultures. [Vliyanie odnokratnogo gamma-obluchenia CO<sup>60</sup> na rost kul'tur khlorelly]. Radiobiologiya 5(5):732-737. 1965. 9 Refs.
357. GRAHN, D., and LANGHAM, W. H. Methods in the evaluation of radiation hazards in manned space flight. In A. Reetz, ed. Second Symposium on Protection Against Radiations in Space, p. 59-64. Washington, D. C., Nat. Aeron. Space Admin., 1965. Refs.
358. GRAY, L. H. Primary mechanisms of radiobiological damage in aerobic and anaerobic systems. In Primary and Initial Processes in the Biological Effects of Radiation, p. 30-56. Air Force Systems Command, Foreign Technol. Div., Wright-Patterson AFB, Ohio, Jan. 29, 1965. Refs.
359. GRAY, S., and EDWARDS, B. F. Effect of weightlessness and radiation on the growth of the wheat coleoptile for the purpose of defining and verifying an experiment suitable for use in a biosatellite. Washington, D. C., Nat. Aeron. Space Admin., Sept. 1965. 64 p. Refs.
360. GRAYBIEL, A. Biological consideration of manned flight in space. J. Amer. Pharm. Ass. NS5:368,369,375. July 1965.
361. GRIGORYEV, YU. G., GUSKOVA, A. K., DOMASHLAK, M. P., VYSOTSKIY, V. G., RAEVSKAYA, S. A., MARKELOV, B. A., and DARENSKAYA, N. G. On the permissible doses of ionizing radiation for space pilots. International Astronautical Federation, International Astronautical Congress, 16th, Athens, Greece, Sept. 13-18, 1965, Paper. 1965. 26 p. 73 Refs.
362. GRIGORYEV, YU. G., KOVALEV, YE. YE., LEBEDINSKIY, A. V., NEFEDOV, YU. G., VYSOTSKIY, V. G., and others. Radiation safety criteria for prolonged spaceflights. [Kriteriy radiatsionnoy bezopasnosti dlitel'nykh kosmicheskikh poletov]. Washington, D. C., Nat. Aeron. Space Admin., June 1965. 24 p. Refs.
363. GROSCH, D. S. Biological effects of radiations. New York, Blaisdell Publishing Co., 1965. 293 p. Refs.
364. GROSCH, D. S. Utilization of Habrobracon and Artemia as experimental materials in bioastronautic studies. Semiannual Status Report, Jan.-June 1965. North Carolina State College, Dept. of Genetics, Raleigh, N. C., 1965. 7 p.

365. HALVORSON, H. O., and SRINIVASAN, V. R. Can spores survive space travel? In H. M. Tsuchiya and A. H. Brown, eds. Proceedings of the Atmospheric Biology Conference, p. 179-185. Minneapolis, Minn., University of Minnesota, 1965. Refs.
366. HELLER, C. G. Effects of ionizing radiation - radiation on testicular function of man. Second Yearly Progress Report, 1 June 1964- 31 May 1965. Pacific Northwest Research Foundation, Seattle, Wash., Mar. 15, 1965. 35 p. Refs.
367. HELVEY, W. M. Critical areas for biomedical research on future manned orbital spacecraft. In P. C. Badgley, ed. Scientific Experiments for Manned Orbital Flight; Proceedings of the 3rd Goddard Memorial Symposium, Washington, D. C., Mar. 18, 1965. p. 273-282. Washington, D. C., American Astronautical Society, 1965. 9 Refs.
368. HIGGINS, P. W. Status report on the space radiation effects on the Apollo mission. D. Operational procedures for Apollo dose radiation. In A. Reetz, ed. Second Symposium on Protection against Radiations in Space, p. 151-156. Washington, D. C., Nat. Aeron. Space Admin., 1965.
369. HOLLAENDER, A. Initial stages of radiation damage to chromosomes and methods of their prevention. In Primary and Initial Processes in the Biological Effects of Radiation, p. 241-254. Air Force Systems Command, Foreign Technol. Div., Wright-Patterson AFB, Ohio, Jan. 29, 1965. Refs.
370. HOLZMAN, B. G. The space environment. Air Univ. Rev. 16:54-67. May-June 1965.
371. HUG, O., and SCHLIEP, G. I. Instantaneous reactions of nerves and muscles to ionizing radiation. In Primary and Initial Processes in the Biological Effects of Radiation, p. 272-288. Air Force Systems Command, Foreign Technol. Div., Wright-Patterson AFB, Ohio, Jan. 29, 1965. Refs.
372. IARMONENKO, S. P., and KONOPLIANNIKOV, A. G. Antiradiation protection in connection with the problem of the relative biological effectiveness of seldom-ionizing radiation. [Protivoluchevaya zashchita v svyazi s problemoi otnositel'noi biologicheskoi effektivnosti redkoioniziruyushchikh izlucheniya]. In N. M. Sisakian, ed. Problems of Space Biology. Vol. 4. p. 139-164. Moscow, Izdatel'stvo Nauka, 1965. 124 Refs. In Russian.
373. IVANNIK, B. V., KLIPSON, N. A., MAMEDOVA, T. G., KYABCHENKO, N. I., SKDOBOVSKAYA, M. V., and others. Molecular mechanisms underlying radiation cytogenetic disturbances. In Vestnik of the USSR Academy of Medical Sciences, p. 23-28. Washington, D. C., Joint Publ. Res. Serv., Dec. 7, 1965. Refs.
374. JENKINS, D. W. The NASA Biosatellite Program. In M. Florkin, ed. Life Sciences and Space Research III; International Space Science Symposium, 5th, Florence, Italy, May 12-16, 1964. p. 230-240. Amsterdam, North-Holland Publishing Co., 1965.

375. JONES, R. K., ADAMS, D. E., and RUSSELL, I. J. The radiobiological consequences of dose distributions produced by solar-flare-type spectra. In A. Reetz, ed. Second Symposium on Protection against Radiations in Space, p. 85-96. Washington, D. C., Nat. Aeron. Space Admin., 1965. Refs.
376. KIMEL', L. R., ed. Problems in dosimetry and radiation protection. [Voprosy dozimetriy i zashchity ot izlucheniya]. Moscow, Atomizdat, 1965. 148 p. In Russian.
377. KINNEY, W. E., and ZERBY, C. D. Calculated tissue current-to-dose conversion factors for nucleons of energy below 400 mev. In A. Reetz, ed. Second Symposium on Protection against Radiation in Space, p. 161-172. Washington, D. C., Nat. Aeron. Space Admin., 1965. Refs.
378. KON'KOVA, L. G. Changes in peripheral blood of rats irradiated in the state of hypothermia. [Izmenenie perifericheskoi krovi u krys, o oblyuchennykh v sostoianii gipotermii]. Radiobiologiya 5:198-201. 1965. 12 Refs.
379. KOVALEV, YE. YE., OSANOV, D. P., RADZIEVSKIY, G. B., and MEL'NIK, A. D. Protection of a cosmonaut from electrons and bremsstrahlung in the earth's radiation belt. [Zashchita kosmonavta ot elektronov i tormoznogo izlucheniya v radiatsionnom polase zemli]. Kosm. Issled. 3:782-788. Sept.-Oct. 1965. 16 Refs. In Russian.
380. KRIGER, YU. A., and SVERDLOVA, YE. A. Effect of  $\gamma$ -rays and vibration on the physical and chemical properties of red blood cells. [Vliyanie gamma-luchei i vibratsiy na fiziko-khimicheskie svoistva krasnykhkrovyannykh telet]. Dokl. Akad. Nauk SSSR 160:713-716. Jan. 21, 1965. 13 Refs. In Russian.
381. KRISE, G. M. The effects of prenatal and postnatal gamma irradiation on reproduction in the albino rat. Final Report. Texas A & M University, Radiat. Biol. Lab., College Station, Tex., Sept. 7, 1965. 106 p. Refs.
382. KUZNETSOVA, M. A. Combined effects of vibration and ionizing radiation on the functional state of the spinal reflex arc. In Effects of Ionizing Radiation and of Dynamic Factors on the Functions of the Central Nervous System - Problems of Space Physiology, p. 105-110. Washington, D. C., Nat. Aeron. Space Admin., Aug. 1965.
383. KUZNETSOVA, M. A. Effect of acute whole-body  $\gamma$ -irradiation on excitability of the spinal reflex arc. In Effects of Ionizing Radiation and of Dynamic Factors on the Functions of the Central Nervous System - Problems of Space Physiology, p. 88-96. Washington, D. C., Nat. Aeron. Space Admin., Aug. 1965.

384. LAMBERTS, H. B. Cardiovascular damage by x-irradiation and the possible chemoprotection against this. *Progr. Biochem. Pharmacol.* 1:235-241. 1965.
385. LANGHAM, W. H. Radiation biology and space environmental parameters in manned spacecraft design and operations. *Aerosp. Med.* 36:55 p. Feb. 1965. (Section II). 286 Refs.
386. LIBRARY OF CONGRESS, Aerospace Technology Division, Washington, D. C. Biological effects of microwaves. Surveys of Soviet scientific and technical literature. Sept. 17, 1965. 100 p.
387. LIBRARY OF CONGRESS, Aerospace Technology Division, Washington, D. C. Second international symposium on basic environmental problems of man in space. June 23, 1965. 18 p.
388. LIBRARY OF CONGRESS, Aerospace Technology Division, Washington, D. C. Soviet bioastronautics and biotechnology, 1964: compilation of abstracts. Surveys of Soviet-bloc scientific and technical literature. Feb. 11, 1965. 122 p.
389. LIBRARY OF CONGRESS, Aerospace Technology Division, Washington, D. C. Soviet bioastronautics and manned spaceflight programs, organizations, and personalities. Comprehensive report on surveys of Soviet-bloc scientific and technical literature. Mar. 18, 1965. 118 p.
390. LINDOP, P. J., and ROTBLAT, J. Life shortening in mice exposed to radiation: effects of age and of hypoxia. *Nature* 208:1070-1072. Dec. 11, 1965. 8 Refs.
391. LIVSHITS, N. N. Combined effects of ionizing radiation and other factors. In Effects of Ionizing Radiation and of Dynamic Factors on the Functions of the Central Nervous System - Problems of Space Physiology, p. 1-23. Washington, D. C., Nat. Aeron. Space Admin., Aug. 1965.
392. LOHMANN, W. A possible mechanism for chemical protection against radiation damage. *Progr. Biochem. Pharmacol.* 1:118-136. 1965. 47 Refs.
393. LOUVAIN UNIVERSITY, Laboratoire de Cytogetique, Belgium. Effects of micro-irradiations of chromosome segments. Morphological, biochemical and genetic consequences. [Effets des micro-irradiations de segments chromosomiques. Consequences morphologiques, biochimiques et genetiques]. Final report. Brussels, EURATOM, 1965. 44 p. In French.
394. LUCHNIK, N. V. Biophysical analysis of the primary biological effect of radiation. [Biofizicheskiy analiz pervichnogo biologicheskogo deistviya radiatsiy]. *Vestn. Akad. Med. Nauk SSSR*, No. 9, p. 14-18. 1965. 19 Refs. In Russian.

395. LUK'YANOVA, L. D. Combined effect of general vertical vibration and irradiation on the oxidative processes in the brain of rats. In Effects of Ionizing Radiation and of Dynamic Factors on the Functions of the Central Nervous System - Problems of Space Physiology, p. 126-139. Washington, D. C., Nat. Aeron. Space Admin., Aug. 1965.
396. MARTIN COMPANY, Aerospace Division, Denver, Colorado. Human engineering data and concepts for handling advanced nuclear systems in space. Research and Technology Implications Report. July 1965. 29 p.
397. MAXWELL, D. S., and KRUGER, L. Small blood vessels and the origin of phagocytes in the rat cerebral cortex following heavy particle irradiation. Exp. Neurol. 12:33-54. May 1965. 48 Refs.
398. MAZELLA, G., and PAOLUCCI, G. Effects of ionizing radiation in animals protected with hypoxia or with chemicals. [Effetti delle radiazioni ionizzanti in animali protetti mediante ipossia o mediante alcune sostanze chimiche]. Riv. Med. Aeronaut. Spaziale. 28:302-312. July-Sept. 1965. 7 Refs. In Italian.
399. McDONNELL AIRCRAFT CORPORATION and the UNIVERSITY OF CALIFORNIA, Los Alamos Scientific Laboratory. Radiation biology and space environmental parameters in manned spacecraft and design and operations. Aerosp. Med. 36:62 p. Feb. 1965. (Section II)
400. MICHAELSON, S. M., ANGEL, C. R., WOODWARD, K. T., and HOWLAND, J. W. Biochemical aspects of radiation injury and recovery. University of Rochester, Dept. of Radiation Biology, Rochester, N. Y., 1965. 9 p.
401. MIQUEL, J., and HAYMAKER, W. Astroglial reactions to ionizing radiation - with emphasis on glycogen accumulation. In E. D. P. De Robertis and R. Carrea, eds. Progress in Brain Research. Vol. 15. p. 89-114. Amsterdam, Elsevier Publishing Co., 1965. 49 Refs.
402. MOLL, I. M. Space radiation and its biological impact. [La radiactividad espacial y su impacto biologico]. Rev. Aeronaut. Astronaut. 25:860-866. Oct. 1965. In Spanish.
403. MOROZOV, V. S., SHASHKOV, V. S., DAVYDOV, B. I., ANTIPOV, V. V., SAKSONOV, P. P., and DOBROV, N. N. Simulation of radiation conditions during the occurrence of a solar flare on a circum-lunar trajectory. [Modelirovaniye radiatsionnykh usloviy pri voz-niknoveniy solnechnoi vspyshkina traektoriy obleta luny]. In N. M. Sisakian, ed. Problems of Space Biology. Vol. 4. p. 701-708. Moscow, Izdatel'stvo Nauka, 1965. 12 Refs. In Russian.



404. NAKACHE, F. R. Analytical formulation of proton dose rates behind spherical multilayer shields. In A. Reetz, ed. Second Symposium on Protection against Radiations in Space, p. 485-491. Washington, D. C., Nat. Aeron. Space Admin., 1965. Refs.
405. NEFEDOVA, YU. G. Problems of radiation safety of space flights. Physical and biological investigations with high-energy proton. Rept. No. FTD-MT-65-159. Air Force Systems Command, Foreign Technol. Div., Wright-Patterson AFB, Ohio, Dec. 27, 1965. 231 p.
406. NUZHON, N. I., DOZORTSEVA, R. L., PASTUSHENKO-STRELETS, N. A., and others. The effect of cosmic flight factors on seeds of the spindle-tree (Euonymus europaea L.). Washington, D. C., Joint Publ. Res. Serv., Oct. 5, 1965, 10 p. Refs. Transl. from Izv. Akad. Nauk SSSR, Ser. Biol. (Moscow) No. 4, p. 576-580. July-Aug. 1965.
407. PAINTER, R. B., and RASMUSSEN, R. E. Conditions affecting the early thymineless death occurring after ultraviolet irradiation of Escherichia coli B3. Photochem. Photobiol. 4:61-65. 1965. 13 Refs.
408. PARFENOV, G. P. Appearance of dominant lethals in a Drosophila under the effect of vibrations, acceleration, and gamma radiation. [Vozniknovenie dominantnykh letalei u drozofily pod vliyaniem vibratsiy, uskoreniya i  $\gamma$ -oblucheniya]. Kosm. Issled. 3: 643-651. July-Aug. 1965. 11 Refs. In Russian.
409. PARIN, V. V., and others. Space flight physiology. Washington, D. C., Joint Publ. Res. Serv., Mar. 17, 1965. Refs. Transl. from Izv. Akad. Nauk SSSR, Ser. Biol. (Moscow) No. 1, p. 3-22. 1965.
410. PARIN, V. V., ANTIPOV, V. V., DAVYDOV, B. I., TSCHERNOV, G. A., and PANCHENKOVA, E. F., Results of investigations concerning the biological effect of a series of cosmic flight factors. Air Force Systems Command, Aerospace Medical Div., Brooks AFB, Tex., Jan. 1965. 22 p.
411. PASYNSKIY, A. G. Effect of radiation on proteins and nucleic acids in solution and on interfaces. In Primary and Initial Processes in the Biological Effects of Radiation, p. 57-73. Air Force Systems Command, Foreign Technol. Div., Wright-Patterson AFB, Ohio, Jan. 29, 1965. Refs.
412. PEREPELKIN, S. R., The protective role of food and vitamins in radiation effect on the body. [O zashchitnoi roli pishchi i vitaminov pri luchevykh porazheniyakh organizma]. Gig. Sanit. 3:48-56. Mar. 1965. 29 Refs. In Russian.
413. PLANEL, H., SOLEUHAVOUP, J.-P., and TIXADOR, R. Investigation on the action of natural ionizing radiations on the growth of unicellular organisms. [Recherches sur l'action des radiations ionisantes naturelles sur la croissance d'etres unicellulaires]. Comp. Rend. Acad. Sci. Paris 260:3770-3773. Mar. 29, 1965. In French.

414. POLLARD, E. C. Effect of ionizing radiation on protein synthesis in the cell. In Primary and Initial Processes in the Biological Effects of Radiation, p. 82-101. Air Force Systems Command, Foreign Technol. Div., Wright-Patterson AFB, Ohio, Jan. 29, 1965. Refs.
415. POLLARD, E. C. Physics of cellular synthesis, growth, and division. Annual Status Report, Apr. 1, 1964-Mar. 31, 1965. Pennsylvania State University, University Park, Penna., Apr. 30, 1965. 14 p. Refs.
416. POWERS, E. L. Chemical states arising in cells during x-irradiation and their role in radiation damage. In Primary and Initial Processes in the Biological Effects of Radiation, p. 102-123. Air Force Systems Command, Foreign Technol. Div., Wright-Patterson AFB, Ohio, Jan. 29, 1965. Refs.
417. PRESMAN, A. Effect of electromagnetic radiations on living organisms. Washington, D. C., Joint Publ. Res. Serv., Aug. 10, 1965. 17 p. Transl. from Nauki i Zhizn' (Moscow), No. 5, p. 82-88. May 1965.
418. SAKSONOV, P. P., ANTIPOV, V. V., SHASHKOV, V. S., RAZGOVOROV, B. L., MURIN, G. F., and MOROZOV, V. S. Biological effect of high-energy protons. [O biologicheskoy deystviy protonov vysokikh energiy]. Dokl. Akad. Nauk SSSR 162:688-690. May 21, 1965. 14 Refs.
419. SAKSONOV, P. P., ANTIPOV, V. V., DOBROV, N. N., SHASHKOV, V. S., KOZLOV, V. A., PARSHIN, V. S., DAVYDOV, B. I., RAZGOVOROV, B. L., MOROZOV, V. S., and NIKITIN, M. D. Possibilities for pharmacochemical protection from radiation injuries during space flights. [Perspektivy farmakokhimicheskoy zashchity ot radiatsionnykh porazheniy pri kosmicheskikh poletakh]. In N. M. Sisakian, ed. Problems of Space Biology. Vol. 4. p. 119-126. Moscow, Izdatel'stvo Nauka, 1965. 68 Refs.
420. SCHAEFER, H. J. Local dose from proton and alpha particle enders behind complex shield systems. In A. Reetz, ed. Second Symposium on Protection Against Radiations in Space, p. 507-512. Washington, D. C., Nat. Aeron. Space Admin., 1965. Refs.
421. SCHAEFER, H. J. Radiation exposure in solar particle beams behind very low shielding. Naval Sch. Aviat. Med., Pensacola, Fla., Feb. 19, 1965. 14 p. Refs.
422. SCHAEFER, H. J. Tissue dosages from alpha particles and heavy nuclei in solar particle beams in space. Naval Sch. Aviat. Med., Pensacola, Fla., June 17, 1965. 15 p. Refs.
423. SCHAEFER, G., and WEINER, K. H. Chemical radioprotection during flight in higher altitudes and in manned spaceflights. [Chemischer Strahlenschutz bei Flügen in grossen Höhen und in der bemannten Raumfahrt]. In W. Briegleb, comp. Deutsche Luft- und Raumfahrt, Report 65-40. p. 20-23. Deutsche Versuchsanstalt für Luft- und Raumfahrt, Inst. für Flugmedizin, Bad Godesberg, West Germany, Sept. 1965. In German.

424. SHAIDAROV, YU. I. Eliminating the injurious effects of  $\beta$ -radiation on the seeds of cultivated plants with the aid of physiologically active compounds. [Sniatie vrednogo deistviya  $\beta$ - $\text{izlucheniya}$  na vsemena kul'turnykh rasteniy pri pomoshchi fiziologicheskii aktivnykh soedineniy]. In N. M. Sisakian, ed. Problems of Space Biology. Vol. 4. p. 469-473. Moscow, Izdatel'stvo Nauka, 1965. 9 Refs. In Russian.
425. SHAKHOV, A. A., SHISHCHENKO, S. V., STANKO, S. A., SHAIDUROV, V. S., and GOLUBKOVA, B. M. Ultraviolet irradiation of plants as a problem in space phytophysiology. [Ul'trafioletovoe obluchenie rasteniy kak problema kosmicheskoi fitofiziologii]. In N. M. Sisakian, ed. Problems of Space Biology. Vol. 4. p. 474-486. Moscow, Izdatel'stvo Nauka, 1965. 22 Refs. In Russian.
426. SHASHKOV, V. S., and MOROZOV, V. S. Injurious effect of 660- and 120-mev protons and the effectiveness of pharmacochemical protection. [Porazhayushchee deistvie protonov s energiei 660 i 120 mev i effektivnost' farmakokhimicheskoi zashchity]. In N. M. Sisakian, ed. Problems of Space Biology. Vol. 4. p. 401-410. Moscow, Izdatel'stvo Nauka, 1965. 40 Refs. In Russian.
427. SISAKYAN, N. M., GAZENKO, O. G., and ANTIPOV, V. V. Satellite biological experiments + major results and problems. In M. Florkin, ed. Life Sciences and Space Research III; International Space Science Symposium, 5th, Florence, Italy, May 12-16, 1964. p. 185-205. Amsterdam, North-Holland Publishing Co., 1965. 49 Refs.
428. SMITH, H. H. Relative biological effectiveness of different types of ionizing radiations: cytogenetic effects in maize. Brookhaven National Laboratory, Biology Dept., Upton, N. Y., 1965. 4 p. Refs.
429. SONDHAUS, C. A. Effect of high-energy protons and alpha particles on small mammals. In A. Reetz, ed. Second Symposium on Protection against Radiations in Space, p. 97-103. Washington, D. C., Nat. Aeron. Space Admin., 1965. Refs.
430. SOSKA, J., BENES, L., DRASIL, V., KARPFEL, Z., PALECEK, E., and others. The role of free deoxyribonucleotides in the origin of radiation injury. In Primary and Initial Processes in the Biological Effects of Radiation, p. 185-198. Air Force Systems Command, Foreign Technol. Div., Wright-Patterson AFB, Ohio, Jan. 29, 1965. Refs.
431. STAHLHOFEN, W., comp. Radiation effects on living tissues and organisms. Series C. Bibliographies. Frankfurt am Main, West Germany, Max Planck Institut fur Biophysik, Apr. 1965. 248 p. Refs. In German; English summary.

432. STAPLETON, G. E. Lethal, mutagenic, and cytogenetic effects of fast charged particles on various biological materials. In A. Reetz, ed. Second Symposium on Protection against Radiations in Space, p. 65-71. Washington, D. C., Nat. Aeron. Space Admin., 1965. Refs.
433. STEWARD, P. G. Results of computations of depth dose in tissue irradiated by protons. University of California, at Berkeley, Lawrence Radiation Lab., Berkeley, Calif., May 25, 1965. 119 p. Refs.
434. SWENSON, P. A. Inhibition of the synthesis of the macromolecules by ultraviolet radiations. Progress Report. University of Massachusetts, Amherst, Mass., 1965. 5 p. Refs.
435. TAKETA, S. T. Biological effects of protons and neutrons in large animals. In A. Reetz, ed. Second Symposium on Protection against Radiations in Space, p. 73-74. Washington, D. C., Nat. Aeron. Space Admin., 1965. Refs.
436. TOBIAS, C. A., BRUSTAD, T., and MANNEY, T. Investigation of enzymes and yeast cells by means of accelerated heavy ions. In Primary and Initial Processes in the Biological Effects of Radiation, p. 255-271. Air Force Systems Command, Foreign Technol. Div., Wright-Patterson AFB, Ohio, Jan. 29, 1965. Refs.
437. TODD, P. Biological effects of heavy ions. In A. Reetz, ed. Second Symposium on Protection against Radiations in Space, p. 105-114. Washington, D. C., Nat. Aeron. Space Admin., 1965. Refs.
438. TSINGA, E., and CASARETTI, G. W. Mitochondria and radiation sensitivity of cells. University of Rochester, Rochester, N. Y., July 19, 1965. 77 p. Refs.
439. VOLYNKIN, YU. M., ANTIPOV, V. V., GUDA, V. A., NIKITIN, M. D., and SAKSONOV, P. P. Biological estimate of radiation conditions on the earth-moon trajectory. [Biologicheskaya otsenka radiatsionnykh usloviy na trasse zemlya-luna]. In N. M. Sisakian, ed. Problems of Space Biology. Vol. 4. p. 127-138. Moscow, Izdatel'stvo Nauka, 1965. 41 Refs. In Russian.
440. VOLYNKIN, YU., SAKSONOV, P., and DOBROV, N. Radiation barrier and man in space. Washington, D. C., Joint Publ. Res. Serv., Apr. 19, 1965. 9 p. Transl. from Izv. Akad. Nauk SSSR, Mar. 21, 1965, p. 2.
441. WALLACE, R., STEWARD, P. G., and SONDHAUS, C. Primary and secondary-proton dose rates in spheres and slabs of tissue. In A. Reetz, ed. Second Symposium on Protection against Radiations in Space, p. 301-329. Washington, D. C., Nat. Aeron. Space Admin., 1965. Refs.

442. ZARET, M. M. Ophthalmic effects associated with ionizing and non-ionizing electromagnetic radiation fields. International Astronautical Federation, International Astronautical Congress, 16th, Athens, Greece, Sept. 13-18, 1965, Paper. 1965. 4 p.
443. ZERBY, C. D., and KINNEY, W. E. Calculated tissue current-to-dose conversion factors for nucleons below 400 mev. Oak Ridge, National Laboratory, Neutron Physics Div., Oak Ridge, Tenn., May 1965. 81 p. Refs.
444. ZHUKOV-VEREZHNIKOV, N. N., VOLKOV, M. N., RYBAKOV, N. I., SAKSONOV, P. P., KOZLOV, V. A., KONSTANTINOV, P. A., ANTIPOV, V. V., DOBROV, N. N., and ANISKIN, E. D. New trends in the study of chemical protection from genetic changes. [Novye puti izucheniya khimicheskoi zashchity ot geneticheskikh izmeneniy]. In N. M. Sisakian, ed. Problems of Space Biology. Vol. 4. p. 445-450. Moscow, Izdatel'stvo Nauka, 1965. 16 Refs. In Russian.
445. ZHUKOV-VEREZHNIKOV, N. N., MAISKIY, I. N., PEKHOV, A. P., RYBAKOV, N. I., TRIBULEV, G. P., SAKSONOV, P. P., MISHCHENKO, B. A., ANTIPOV, V. V., KOZLOV, V. A., RYBAKOVA, K. D., VYSOTSKIY, V. G., DOBROV, N. N., PANTIUKHOVA, V. V., and ANISKIN, E. D. Study of the phagoproduction of E. coli K-12 ( $\lambda$ ) induced during Vostok 3 and 4 space flights. [Izucheniye fagoproduktsiy E. coli K-12 ( $\lambda$ ), indutsirovannoi v usloviyakh poletov kosmicheskikh korablei "Vostok-3" i "Vostok-4"]. Kosm. Issled. 3:487-491. May-June 1965. 12 Refs. In Russian.

446. AINSWORTH, E. J., KENDALL, K., MITCHELL, F. A., and PHILLIPS, T. L. Radiation-protection and recovery from radiation injury in endotoxin-treated mice. Hematopoietic recovery and sensitivity to a second radiation exposure. Naval Radiological Defense Laboratory, San Francisco, Calif., May 23, 1966. 47 p. Refs.
447. AIR FORCE SYSTEMS COMMAND, Foreign Technology Division, Wright-Patterson AFB, Ohio. Cosmic research, Volume 4, Number 1, 1966. June 23, 1966. 318 p. Refs. Transl. from Kosm. Issled. (Moscow) 4(1):1-175. 1966.
448. ALEKSANDRYUK, S. P., ANISIMOV, B. V., KOMAROV, N. N., NEFEDOV, YU. G., POTAPOV, A. N., and others. Ionization of the air as one of the factors of space flight. In Problems in Aerospace Medicine, p. 22-23. Washington, D. C., Joint Publ. Res. Serv., Oct. 21, 1966.
449. ANDRIANOVA, L. A. The change of the neurosecretory activity of the hypothalamic region under the action of some extreme factors of space flight. In Problems in Aerospace Medicine, p. 34-35. Washington, D. C., Joint Publ. Res. Serv., Oct. 21, 1966.
450. ANTIPOV, V. V., KOZLOV, V. A., DDAVYDOV, B. I., DOBROV, N. N., RAZGOVOROV, B. L., and others. New data on the change of the reactivity of the body under the influence of certain factors of space flight. In Problems in Aerospace Medicine, p. 36. Washington, D. C., Joint Publ. Res. Serv., Oct. 21, 1966.
451. ARLASHCHENKO, N. I. The role of the vestibular analyzer in the response reactions of an organism to radiation effects. In Problems in Aerospace Medicine, p. 45. Washington, D. C., Joint Publ. Res. Serv., Oct. 21, 1966.
452. ARSEN'YEVA, M. A., ANTIPOV, V. V., BELYAYEVA, L. A., and GOLOVKINA, A. V. The combined effect of accelerations, vibrations, and radiation on the division of the cells of the bone marrow. In Problems in Aerospace Medicine, p. 47-48. Washington, D. C., Joint Publ. Res. Serv., Oct. 21, 1966.
453. ATLAN, H. Biological effects of heavy particles. [Effets biologiques des particules lourdes]. Rev. Med. Aeronaut. 5:53-57. Apr.-June 1966. 12 Refs. In French.
454. BROWN, F. A., PARK, Y. H., and ZENO, J. R. Diurnal variation in organismic response to very weak gamma radiation. Nature 211: 830-833. Aug. 20, 1966. 16 Refs.
455. DALRYMPLE, G. V., LINDSAY, I. R., GHIDONI, J. J., MITCHELL, J. C., and MORGAN, I. L. An estimate of the biological effects of the space proton environment. Radiat. Res. 28(2):548-566. 1966.

456. DAVYDOV, B. I. Capability of sustaining extreme accelerations after exposure to ionizing radiation. [Perenosimost' ekstremal'nogo uskoreniya posle vozdeistviya ioniziruyushchei radiatsiy]. Dokl. Akad. Nauk SSSR 168:691-693. May 21, 1966.
457. DODGE, C. H. Soviet biotechnology and bioastronautics. Surveys of Foreign Scientific and Technical Literature, 30 June - 31 Dec. 1965. Washington, D. C., Library of Congress, Aerospace Technology Div., June 15, 1966. 169 p. Refs. Compilation of abstracts.
458. DODGE, C. H., and SMITH, J. L. The effect of space flight factors on central nervous system functions. Surveys of Foreign Scientific and Technical Literature. Washington, D. C., Library of Congress, Aerospace Technology Div., Aug. 4, 1966. 42 p. Refs. Summary of data.
459. DROGICHINA, E. A., KONCHALOVSKAYA, N. M., GLOTOVA, K. V., SADCHIKOVA, M. N., and SNEGOVA, G. V. Autonomic and cardiovascular disorders during chronic exposure to super-high frequency electromagnetic fields. Rept. No. ATD-66-124. Washington, D. C., Library of Congress, Aerospace Technology Div., Oct. 6, 1966. 8 p. Transl. from Gig. Tr. Prof. Zabol. (USSR) 10(7):7-13. 1966.
460. EWING, D. E. An experimental approach for determining the space radiation hazard to manned space flight. In Third Space Congress: The Challenge of Space, p. 201-205. Fla., Canaveral Council of Technical Societies, 1966. Refs.
461. GAIDAMAKIN, N. A., PETRUKHIN, V. G., ANTIPOV, V. V., SAKSANOV, P. P., and SHASHKOV, V. S. Pathomorphological changes in hemopoietic organs of mice exposed to the synergistic effect of ionizing radiation and dynamic space flight factors. [Patomorfologicheskie izmeneniya v krovetvornykh organakh myshei pri kombinirovannom deistviy nekotorykh vidov ioniziruyushchei radiatsiy i dinamicheskikh faktorov kosmicheskogo poleta]. Izv. Akad. Nauk SSSR, Ser. Biol., No. 3, p. 346-354. May-June 1966. 20 Refs. In Russian.
462. GLASS, B. H. The action of radiation and other mutagenic agents. 1: in inducing mutation in *Drosophila* females, and 2: in controlling the action of specific genes responsible for suppressing uncontrolled growth. Final Report, 1 May 1953 - 21 Dec. 1965. Johns Hopkins University, Baltimore, Md., Feb. 28, 1966. 36 p. Refs.
463. GRAEVSKIY, E. YA. Some results and problems in the study of radiation-protection mechanisms. [Nekotorye itogi i zadachi izucheniya mekhanizmov protivoluchevoi zashchity]. Izv. Akad. Nauk SSSR, Ser. Biol., No. 3, p. 376-382. May-June 1966. 30 Refs. In Russian.
464. GUROVSKIY, N. The "Biosputnik" is conducting investigations. [Biosputnik vedet issledovaniya]. Washington, D. C., Nat. Aeron. Space Admin., Nov. 1966. 5 p. Transl. from Aviats. Kosmonavt. (Moscow) No. 5, p. 32-34. 1966.

465. HASEGAWA, A. T., and LANDAHL, H. D. Studies on spleen oxygen tension and radioprotection in mice with hypoxia, serotonin and p-aminopropiophenone. Formal Report, Dec. 1, 1965-May 31, 1966. University of Chicago, Toxicity Lab., Chicago, Ill., June 1966. 24 p. Refs.
466. IVANOV, N. I. Histological changes in the inner ear of animals exposed to x-irradiation. [Gistologicheskiye izmeneniya vo vnutrennem uke zhivotnykh podvergnutykh rentgenovskomu oblucheniyu]. Washington, D. C., Nat. Aeron. Space Admin., Nov. 1966. 9 p. Refs. Transl. from Vestn. Otorinolaringol. (Moscow) 18:78-83. 1957.
467. JAMIESON, D. Ionizing radiation and the intracellular oxidation-reduction state. Nature 209:361-365. Jan. 22, 1966. 48 Refs.
468. KALININA, T. V. The role of the cervical and abdominal regions of the sympathetic nervous system in changes of the blood and blood circulation upon the action of chronic hypoxia and ionizing radiation. In Problems in Aerospace Medicine, p. 246-247. Washington, D. C., Joint Publ. Res. Serv., Oct. 21, 1966.
469. KON'KOVA, L. G. The radiation sensitivity of white rats under conditions of hypothermia. In Problems in Aerospace Medicine, p. 283-284. Washington, D. C., Joint Publ. Res. Serv., Oct. 21, 1966.
470. KONNOVA, N. I. The combined action of acceleration and ionizing radiation on the organism of animals. In Problems in Aerospace Medicine, p. 282. Washington, D. C., Joint Publ. Res. Serv., Oct. 21, 1966.
471. KOVALEV, YE. YE., POPOV, V. I., and SYCHKOV, M. A. Basic problems of modeling the effects of space radiation on biological objects. In Problems in Aerospace Medicine, p. 268. Washington, D. C., Joint Publ. Res. Serv., Oct. 21, 1966.
472. KOZLOV, M. YA. Changes in the peripheral division of the auditory analyzer in acute radiation sickness. [Izmeneniye perifericheskogo otdela slukhovogo analizatora pri ostroy luchevoy bolezni]. Washington, D. C., Nat. Aeron. Space Admin., Oct. 1966. 11 p. Refs. Transl. from Vestn. Otorinolaringol. (Moscow) 20(2): 29-35. 1958.
473. KUDRYASHOV, YE. I., MARENYY, A. M., POPOV, V. I., PORTMAN, A. I., SOLYANOV, B. I., and others. A method of irradiating biological objects with a multiple charged ion accelerator. In Problems in Aerospace Medicine, p. 304-305. Washington, D. C., Joint Publ. Res. Serv., Oct. 21, 1966.
474. KUZIN, R. A., NEVSKAYA, G. F., POPOV, V. I., SYCHKOV, M. A., SHAFIRKIN, A. V., and others. Experimental investigation of the effectiveness of local protection. In Problems in Aerospace Medicine, p. 306-307. Washington, D. C., Joint Publ. Res. Serv., Oct. 21, 1966.



475. KUZNETSOVA, M. A. The influence of the complex action of multiple vibration and fractionated irradiation on the state of the arch of the spine-brain reaction. In Problems in Aerospace Medicine, p. 320. Washington, D. C., Joint Publ. Res. Serv., Oct. 21, 1966.
476. LEBEDEV, K. A. The influence of immunization on the resistance of an organism to the radiation factor of the space flight. In Problems in Aerospace Medicine, pp. 326-328. Washington, D. C., Joint Publ. Res. Serv., Oct. 21, 1966.
477. LIVSHITS, N. N., APANASENKO, Z. I., KUZNETSOVA, M. A., LUK'YANOVA, L. D., and MEYZEROV, YE. S. The combined action of vibration and ionizing radiation on the metabolism and functioning of the central nervous system. In Problems in Aerospace Medicine, p. 334-335. Washington, D. C., Joint Publ. Res. Serv., Oct. 21, 1966.
478. LIVSHITS, N. N., and MEYZEROV, YE. S. The complex action of vibration and ionizing radiation on the conditioned reflex activity of rats. In Problems in Aerospace Medicine, p. 336-337. Washington, D. C., Joint Publ. Res. Serv., Oct. 21, 1966.
479. LOSHAK, A. YA. The question of the biological effect of combined x-ray and superhigh frequency radiation. In Problems in Aerospace Medicine, p. 340-341. Washington, D. C., Joint Publ. Res. Serv., Oct. 21, 1966.
480. L'VOVA, T. S. Combined effect of ionizing radiation and vibration on living organisms. [Kompleksnoe vozdeistvie na organizm zhivotnogo ioniziruyushchego izlucheniya i vibratsiy]. Izv. Akad. Nauk SSSR, Ser. Biol., No. 3, p. 355-361. May-June 1966. 20 Refs. In Russian.
481. L'VOVA, T. S. The influence of vibration on the course and outcome of radiation injury in animals. In Problems in Aerospace Medicine, p. 347-348. Washington, D. C., Joint Publ. Res. Serv., Oct. 21, 1966.
482. MELVILLE, G. S. JR., HARRISON, G. W. JR., MCDOWELL, A. A., WRIGHT, J. F., BROWN, W. L., and HEKHUIS, G. L. Some effects of macro-fractionated gamma ray irradiation upon the rhesus primate. In Aerospace Medical Association, Annual Scientific Meeting, 37th, Las Vegas, Nev., Apr. 18-21, 1966, Preprints, p. 195-196. Washington, D. C., Aerospace Medical Association, 1966. Abridged.
483. MICHAELSON, S. M., THOMSON, R. A. E., and QUINLAN, W. J. Effects of electromagnetic radiations on physiologic responses. In Aerospace Medical Association, Annual Scientific Meeting, 37th, Las Vegas, Nev., Apr. 18-21, 1966, Preprints, p. 71-72. Washington, D. C., Aerospace Medical Association, 1966. 9 Refs. Abridged.
484. MIQUEL, J., and HAYMAKER, W. Glycogen accumulation in monkey and cat brain exposed to proton radiation. Excerpta Med. Int. Congr. Ser., No. 100, p. 792-797. 1966. 6 Refs.

485. MOROZOV, V. S., SHASKOV, V. S., and DAVYDOV, B. I. Biological-effect simulation of monoenergetic proton-flux depth dose. In Cosmic Research, p. 284-289. Air Force Systems Command, Foreign Technol. Div., Wright-Patterson AFB, Ohio, June 23, 1966. Refs.
486. NEUMAN, W. F. Radiation in space. In Human Ecology in Space Flight, Vol. 1. p. 205-242. New York, New York Academy of Sciences, 1966. Refs.
487. NEVILLE, T., and LAWRENCE, J. H., eds. Studies of heavily ionizing particles and space biology, Semiannual Report. University of California at Berkeley, Lawrence Radiation Lab., Berkeley, Calif., 1966. 161 p. Refs.
488. NEVZGODINA, L. V., and GRIGOR'YAN, N. M. The effect of ionizing radiation on the chromosome apparatus of higher plants. In Problems in Aerospace Medicine, p. 371. Washington, D. C., Joint Publ. Res. Serv., Oct. 21, 1966.
489. PETERS, I. G., and HAMILTON, H. E. Postirradiation creatinuria and Macaca mulatta primates. Sch. Aerosp. Med., Brooks AFB, Tex., Aug. 1966. 12 p. Refs.
490. PETROV, I. R., and SUBBOTA, A. G. Effect of the superhigh frequency electromagnetic radiation on the organism. [O vliyaniy elektromagnitnykh izlucheni svch diapazona na organizm]. Voennomed. Zh. No. 2, p. 16-21. Feb. 1966. 9 Refs. In Russian.
491. PHILLIPS, T. L., and HANKS, G. H. Apparent absence of recovery in endogenous colony-forming cells after irradiation under hypoxic conditions. Naval Radiological Defense Laboratory, San Francisco, Calif., Oct. 24, 1966. 35 p. Refs.
492. POLLARD, E. C., and BARONE, T. F. The effect of ionizing radiation on genetic transcription - aspects of the mechanism. Radiat. Res. Suppl. 6:194-200. 1966. 16 Refs.
493. POLLARD, E. C., SWEZ, J., and GRADY, L. Physical characteristics of the residual DNA in bacterial cells after degradation due to ionizing radiation. Radiat. Res. 28:585-596. July 1966. 7 Refs.
494. POPOV, K. Isotopes and ionized radiation as powerful tools of scientific research. Zemedelsko Zname (Sofia), Dec. 4, 1966, p. 2.
495. RADIOBIOLOGICAL INSTITUTE, TNO, Rijswijk, Netherlands. Investigations on bone marrow transplantation in irradiated animals and the production of specific pathogen free animals and their application in radiobiology, 1. Dec. 1962-31 Dec. 1965. Brussels, EURATOM, Sept. 1966. 41 p. Refs.

496. RYBAKOV, N. I., and KOZLOV, V. A. Influence of vibration as a factor associated with space flights on the K-12 (Lambda) E. coli lysogenic cultures [Vliyanie vibratsiy kak faktora, svyazannogo s kosmicheskim poletom, na lizogennuyu kul'tury E. coli K-12 (Lambda)], Byull. Eksp. Biol. Med. 61:64-67. May 1966. In Russian.
497. SAKSONOV, P. P., ANTIPOV, V. V., DOBROV, N. N., KOZLOV, V. A., and SHASHKOV, V. S. Problems of the pharmacochemical protection of an organism from ionizing radiation on space flights. In Problems in Aerospace Medicine, p. 435-436. Washington, D. C., Joint Publ. Res. Serv., Oct. 21, 1966.
498. SCHAEFER, H. J. Radiation hazards to man on the moon. International Astronautical Federation, International Astronautical Congress, 17th, Madrid, Spain, Oct. 9-15, 1966, Paper. 1966. 17 p. 11 Refs.
499. SCHAEFER, H. J. Radiation exposure from heavy nuclei in solar particle beams in space systems of low shielding. Aerosp. Med. 37:1-4. Jan. 1966. 6 Refs.
500. SCHAEFER, H. J., and SULLIVAN, J. J. Radiation monitoring on Gemini missions 4 and 5. In Aerospace Medical Association, Annual Scientific Meeting, 37th, Las Vegas, Nev., Apr. 18-21, 1966, Preprints, p. 182-183. Washington, D. C., Aerospace Medical Association, 1966. Abridged.
501. SETLOW, R. B. Repair of DNA. Oak Ridge National Laboratory, Biology Div., Oak Ridge, Tenn., 1966. 31 p. Refs.
502. SHAKHOV, A. A. The problem of light pulse treatment of seeds and plants. In Electronic Machining and Treatment of Materials, p. 82-99. Washington, D. C., Joint Publ. Res. Serv., May 12, 1966. Refs.
503. SUSLIKOV, V. I. Reduction of the effectiveness of chemical protection with smaller doses of radiation. In Problems in Aerospace Medicine, p. 462-463. Washington, D. C., Joint Publ. Res. Serv., Oct. 21, 1966.
504. SWART, H. Some problems of radiation protection during space flights. I. [Uber einige probleme des strahlenschutzes bei kosmischen flugen. I]. Astronomie und Raumfahrt, No. 4, p. 119-123. 1966. 6 Refs. In German.
505. THOMAS, J. J. JR., BAXTER, R. C., and FENN, W. O. Interactions of oxygen at high pressure and radiation in Drosophila. J. Gen. Physiol. 49:537-549. Jan. 1966. 15 Refs.
506. TYUNOV, L. A., VASIL'YEV, G. A., and VAL'DSHTEYN, E. A. Drugs for radiation protection. Air Force Systems Command, Foreign Technol. Div., Wright-Patterson AFB, Ohio, Feb. 17, 1966. 587 p. Refs. Transl. from the book, "Protivoluchevyye Sredstva". Moscow, Izdatel'stvo Nauka, 1964. 318 p.

507. YAM, K.-M., and DU BOIS, K. P. Effects of ~~x~~irradiation on the hexobarbital metabolizing enzyme system of rat liver microsomes. ~~Formal~~ Report, Dec. 1, 1965-May 31, 1966. University of Chicago, Toxicity Lab., Chicago, Ill., June 1966. 33 p. Refs.
508. YORK, E., HOPPIN, F. G. JR., KUHL, D. E., and HYDE, R. W. Distribution of pulmonary blood flow under forward (+Gx) accelerations - the human centrifuge and radioisotope scanning as tandem techniques to study pulmonary physiology. In Aerospace Medical Association, Annual Scientific Meeting, 37th, Las Vegas, Nev., April 18-21, 1966, Preprints, p. 60-61. Washington, D. C., Aerospace Medical Association, 1966. 12 Refs. Abridged.
509. ZARET, M. M. Ocular effects of microwave radiation. Annual Progress Report, 1 Sept. 1965-1 July 1966. Zaret Foundation, Inc., Scarsdale, N. Y., 1966. 24 p.

1967

510. FUJII, T., IKENAGA, M., and LYMAN, J. T. Killing and mutagenic efficiencies of heavy ionizing particles in Arabidopsis thaliana. Nature 213:175-176. Jan. 14, 1967. 6 Refs.
511. KHOLODOV, YU. A. Space biology and the magnetic field. Rept. No. FTD-HT-66-717. Air Force Systems Command, Foreign Technol. Div., Wright-Patterson AFB, Ohio, Jan. 31, 1967. 8 p. Transl. from Priroda (Moscow), No. 4, p. 114-115. 1966.
512. PETRASH, I. P., and METLITSKIY, L. V. Variations in respiration process during gamma radiation of plant tissue. [Izmeneniya v protsesse dykhaniya pri gamma-oblucheniye rastitel'noy tkani]. Washington, D. C., Nat. Aeron. Space Admin., Mar. 1967. 9 p. Refs. Transl. from Dokl. Akad. Nauk SSSR, 170(3):711-713. 1966.
513. ROME UNIVERSITY, Italy. Study of the action mechanism of ionizing and ultraviolet radiations in vitro cultures of mammalian cells. [Studio del meccanismo d'azione delle radiazioni ionizzanti ed ultraviolette nelle cellule di mammifero in colture in vitro]. Brussels, EURATOM, 1967. 21 p. In Italian; English summary.
514. SMIRNOV, A. D. Changes in nerve cells as a result of the action of ionizing radiation. [Izmeneniya v neyronakh pri vozdeystviy ioniziruyushchego izlucheniya]. Washington, D. C., Nat. Aeron. Space Admin., Jan. 1967. 7 p. Refs. Transl. from Dokl. Akad. Nauk SSSR, Ser. Biofiz., 131(5):1171-1173. 1960.

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FOUNDATIONS OF SPACE BIOLOGY AND MEDICINE  
MONOGRAPH OUTLINE

Status of Author's Activities - September 19, 1967

For clarity, the BSCP has reorganized and condensed the Russian outline into monographs. For a detailed outline of each part and chapter, please refer to the Outline of Contents of March 22, 1967. The remark following the author's or collaborator's name indicates the status of the activities to date.

Monograph #1

Theories of the Origin and Nature of the Universe

Compiler: E. M. Burbidge and/or G. R. Burbidge - acceptance  
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Suggested length 100 pages\*

Physical Characteristics of Interplanetary Space

Compiler: J. A. Van Allen - accepted authorship

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Monograph #2

The Moon and Its Nature

Compiler: H. C. Urey - contract completed

Suggested length 30 pages\*

Planets of the Inner Solar System (Mercury, Venus and Mars)

Compiler: D. G. Rea - contract completed

Suggested length 30 pages\*

Planets of the Outer Solar System and Their Satellites, Asteroids,  
Minor Planets, Meteorites (Including Cosmic Dust) and Comets

Compiler: C. Sagan - contract completed

Suggested length 35 pages\*

Monograph #3

Biological Effects of Extreme Environmental Conditions (Including  
Laboratory Simulation)

Compiler: D. W. Jenkins - accepted - no honorarium

Collaborators: Siegal - contract completed; Zobell - accepted

Suggested length 50 pages\*

Monograph #4

Theoretical and Experimental Prerequisites of Exobiology

Compiler: G. C. Pimental - contract completed

Suggested length 75 pages\*

Monograph #5

Search for and Investigation of Extraterrestrial Forms of Life

Compiler: N. H. Horowitz - declined authorship

Suggested length 100 pages\*

\*Based upon a double-spaced 8½ x 11 typewritten page.



Monograph #6

Planetary Quarantine: Principles, Methods, and Problems  
Compiler: L. B. Hall - no honorarium - accepted  
Suggested length 150 pages\*

Monograph #7

Effect on the Organism of Radiant Energy from Cosmic Space  
Compiler: C. A. Tobias - negotiating contract  
Suggested length 200-250 pages\*

Monograph #8

Effect on the Organism of the Artificial Gaseous Atmosphere of Spacecraft and Stations  
Compiler: E. Roth - accepted - no honorarium  
Suggested length 100 pages\*

Monograph #9

Principles of Gravitational Biology  
Compiler: A. H. Smith - completed contract  
Suggested length 200 pages\*

Monograph #10

Effect on the Organism of Dynamic Flight Factors (Chapters 2, 3, 4, 5 and 6)  
Compiler: A. Graybiel - completed contract  
Suggested length 250-300 pages\*

Monograph #11

Psychophysiological Problems Connected with Flight and Stays in Spacecraft or Space Stations  
Compiler: H. Teuber - no reply to offer of authorship  
Suggested length 150-200 pages\*

Monograph #12

Combined Effect of Various Flight Factors  
Compiler: F. J. De Serres - negotiating contract  
Suggested length 100 pages\*

Monograph #13

Methods of Investigation in Space Biology and Medicine  
Compiler: W. R. Adey - contract completed  
Suggested length 100 pages\*

Monograph #14

Biological Indicators for Space Flight Profiles

Compiler: F. P. Dixon - accepted - no honorarium  
Suggested length 100 pages\*

Monograph #15

Selection of Astronauts

Compiler: New compiler to be contracted possibly  
J. W. Humphreys and Mae M. Link  
Suggested Length 50 pages\*

Training of Astronauts

Compiler: D. K. Slayton - accepted - no honorarium  
Suggested length 100 pages\*

Monograph #16

Methods of Providing Life Support for Astronauts

Compiler: N. Pace - negotiating contract  
Suggested length 100 pages\*

Monograph #17

I. Air Regenerating and Conditioning

II. Integrated Characteristics of Life - Support System Complex

Compiler: R. S. Johnston - declined authorship - new author  
possibly Walton Jones

Suggested length 350 pages\*

Monograph #18

I. Astronauts' Clothing and Personal Hygiene

II. Isolation and Removal of Waste Products

III. Habitability of Spacecraft

IV. Individual Life-support Systems Outside a Spacecraft Cabin, Space  
Suits and Capsules

Compiler: G. Wells - no reply to offer of authorship  
Suggested length 300 pages\*

Monograph #19

Protection of Man Against Adverse Flight Factors

Compiler: New compiler to be contracted possibly C. A. Berry  
Suggested length 150 pages\*

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and Procedures

2nd-order  
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Subjects

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Regular Subjects

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Experimental Subjects

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# BIOSCIENCE

## "CAPSULE"

No. 15

August 7, 1967

Biological Sciences Communication Project, 2000 "P" St., N.W., Washington, D.C. 20036

### BIOSATELLITE PROGRAM

The Biosatellite Program of the National Aeronautics and Space Administration's Bioscience Programs Division is perhaps unique among the Division's activities -- the research it supports is quite specific and, in one sense, limited. Its program consists of 19 high-priority experiments, carried by spacecraft specifically adapted to carry these biological experiment packages, designed to reveal answers to some basic questions concerning the functioning of organisms in the space environment.

The salient points in a brief history of the NASA Biosatellite Program are as follows: In response to a NASA request, the scientific community in late 1962 and early 1963, submitted more than 185 experiment proposals for the Biosatellite which were evaluated by panels of experts and submitted to the Bioscience Committee of the NASA Space Science Steering Committee. Of these experiments, 19 were selected. The first experiment payloads for a Biosatellite were selected in February, 1964, and the spacecraft contract was awarded to General Electric Co., in March. The design of the spacecraft for the three-day mission is complete and the qualification testing for the first flight -- Biosatellite I -- was completed in September 1966. Despite the fact that Biosatellite I was never recovered following its December launch, and thus no experiment data was obtained, much useful information, such as temperatures, partial pressures  $O_2$ , relative humidity, or "g", was recorded on the spacecraft's operation. The next flight is planned for a September 7 launch and it will be another three-day mission with the same experiments as in Biosatellite I. At the same time, the spacecraft for the 21-day and 30-day missions are undergoing developmental tests. Present plans call for putting a total of six Biosatellite spacecraft in a circular orbit, inclined at 33 degrees to the equator, at an altitude between 170 and 200 nautical miles for periods of 3 to 30 days. Two spacecraft are assigned to each principal mission -- for 3-day, 21-day and 30-day flights. The flight schedule calls for flights in 1967, 1968 and 1970.

The

The Biosatellites will experience a maximum of 1/10,000-g rotational acceleration and will have an atmosphere of 20% oxygen and 80% nitrogen at sea-level pressure as well as temperatures controlled within acceptable limits. Cold-gas jets actuated by rate-sensing accelerometers will diminish angular movement in flight and thereby achieve a weightless or near-zero-g environment. Studying the effects of weightlessness on the living organism has top priority among the experiments. The effects of weightlessness plus radiation -- are they synergistic? antagonistic? -- will also be studied on the three-day flight; a strontium-85 source inside the three-day satellite will provide gamma radiation for the study. Identical experiments that are not irradiated will serve as controls to distinguish the effect of weightlessness alone from the combined effects.

In commenting on the Biosatellite Program, Program Manager Thomas P. Dallow observes that one of the most remarkable outgrowths of the Program has been the exceptional manner in which experimenters from various parts of the country, and from various institutions, have learned to work together as a team. This has been especially important in carrying out tests, etc., for the three-day flight. The experimenters have had to overcome many difficulties with biological compatibility of the experiment packages, and had to train and practice for loading the spacecraft in the very short time required by the biological material being used. Mr. Dallow points out that since the first systems test in Philadelphia through to the pre-launch phase, these scientists and engineers have been working to solve this problem. Now they are a well-disciplined team that can start the loading activity 13 hours before launch and, working with the spacecraft technicians, be done four hours before launch in order to leave this time for the final launch vehicle preparation.

Some concept of the scope of the Biosatellite experiments team can be obtained by simply listing the institutions involved: North Carolina State University, Raleigh; Texas Woman's University; University of California at Los Angeles and at Berkeley; University of Virginia; Bowling Green State University; University of Texas, Dallas; University of Pennsylvania; University of Minnesota; Colorado State University; University of Southern California; Emory University; Rice University; Dartmouth College; Brookhaven National Laboratory; Oak Ridge National Laboratory; Jet Propulsion Laboratory; Harbor General Hospital, Los Angeles; North American Aviation; General Electric; Texas Instruments; Battelle N.W.; NUS Corporation; Northrop; Philco.

A further outgrowth of the Biosatellite Program has been the impressive techniques developed for 30-day flight of the Biosatellite and monitoring its primate passenger. Mr. Dallow cites just a few of these: Deep brain probes with special signal conditioners provide data on the central nervous system performance and behavior. Automated, wet-chemistry urinalysis equipment has been developed that measures quantitatively every six hours the creatin, creatinine, and calcium excreted thereby monitoring metabolic processes in the animal during flight. (The catheterization method, developed by Dr. Abraham Cockett of Harbor General Hospital, Los Angeles, used for the monkey is unique; in positive performance tests it has remained in place for 30 days with no ill effect on the animal.) A dime-sized transmitter has been developed by researchers at Franklin Institute of Philadelphia and Northrop which is a complete system for transmitting temperature within a cavity (such as the stomach) with a sensitivity of  $0.1^{\circ}\text{C}$ . It is small enough to be used in rats and has been so used for as long as 21 days, although it is designed with an operating life of one month or more. This transmitter will be used to determine the biological rhythms of the animals while they are in orbit and removed from the normal 24-hour cycles.

The Biosatellite Program is designed with a capability for multiple biology experiments. It embraces experiments on behavior and orientation; cardiovascular function; extra-terrestrial biorhythms; metabolic requirements; neurological adaptation; plant development and geotropism; and radiobiological effects.

Specifically, for the three-day mission, the following "general biology" experiments will be flown:

- 1) Liminal angle in the pepper plant, J.C. Finn and S.P. Johnson of North American Aviation Inc, and T. Tibbits, University of Wisconsin.
- 2) Nutrition and growth in Pelomyxa Carolinensis, R.W. Price, University of Colorado, and D. E. Ekberg, General Electric Co.
- 3) Development of frog eggs; R.S. Young, and J. Tremor, Ames Research Center.
- 4) Orientation of roots and shoots in wheat seedlings, S.W. Gray and B.F. Edwards, Emory University; Emergence of wheat seedlings, C.J. Lyon, Dartmouth College; and, Orientation of root and shoot of corn, H.M. Conrad and S.P. Johnson. (These will be flown combined as one experiment.)

The following radiation experiments will also be flown:

- 1) Cellular inactivation and mutation in Neurospora spores, F.J. DeSerres and B.B. Webber, Oak Ridge National Laboratories.
- 2) Embryonic development in Tribolium, J.V. Slater, University of California.
- 3) Chromosome translocation in Habrobracon, R.C. von Borstel, A.R. Whiting, R.H. Smith and R.L. Amy of Oak Ridge National Laboratories, and D.S. Grosch, University of North Carolina.
- 4) Somatic mutation in Tradescantia, A.H. Sparrow and L.A. Schairer, Brookhaven National Laboratory.
- 5) Viral induction in lysogenic bacteria, R. Mattoni, North American Aviation, W.T. Ebersold and W.T. Romig, University of California, and E.T. Keller, Jr., University of Maryland.
- 6) Genetic changes in mature germ cells of adult Drosophila, E. Altenburg and L. Browning, Texas Medical Center.
- 7) Somatic damage in larvae of Drosophila, I. Oster, Cancer Research Institute, Philadelphia, Pa.

#### NEWS FROM COSPAR

Analysis of results from fertilized frog egg experiment packages recovered from Gemini 8 and 12 spacecraft indicates that a gravitational field is apparently not necessary for the egg to divide and differentiate normally. This is the conclusion reached despite the fact that the frog egg is known to orient itself with respect to gravity during its very early development in the normal Earth environment. Dr. Richard Young, new chief of the Exobiology Program at NASA's Bioscience Division, reported results of the Gemini 8 and 12 experiments at the 10th meeting of the Committee on Space Research (COSPAR), held in London July 24-29. (The complete text of Dr. Young's paper, co-authored by Dr. J.W. Tremor of NASA's Ames Research Center, including illustrations of the experiment package and photographs of the frog embryos and the developed tadpoles, will appear in the published proceedings of the meeting. Write to the COSPAR Executive Secretary, Mr. M.J. Gazin, 55 Boulevard Malesherbes, Paris 8, France, for information on the proceedings.)

Dr. Young suggests that "The remaining and perhaps most significant question is whether the frog egg will divide and develop normally if it is fertilized under zero-g conditions, so that it never has a chance to become oriented with respect to gravity." Recent experiments, carried out by Dr. Young and Drs. P. Deal and K. Souza, using centrifuged frog eggs showed that the frog egg is most sensitive to gravity during the time between fertilization and first cleavage. In the Gemini experiments, notes Dr. Young, the eggs were at one g during most of that time. Hopefully there will be an opportunity in later flights to fertilize frog eggs in flight and thus resolve this question.

The Gemini 8 and 12 experiments were identical: The experiment package was mounted on the hatch of the spacecraft and each had four chambers containing fertilized frog eggs in pond water. There was a partitioned section containing a concentration of 0.5% formalin which could be injected into three of the chambers. (The fourth chamber contained water only so that the frog embryos could be returned alive.) Each chamber contained five eggs in about 10 cc of pond water. The experiment was installed in the spacecraft about 2 1/2 hours before launch and, prior to installation, had been kept at about 6°C to retard first cleavage. (Eggs were obtained from the females (Rana pipiens) by injection of frog pituitary glands about 48 hours before launch and the best eggs were fertilized by immersing them in a sperm suspension made by macerating frog testes in pond water.) Two sets of control experiments were set up: One carried out simultaneously with the flight experiments, the other carried out two hours later and including corrections for the temperature changes experienced by the frog eggs in flight. At 41 hours post-launch two chambers were to be injected with the formalin fixative, and at 85 hours, the eggs in the third chamber were to be fixed. (In Gemini 8 flight, the later stages were not obtained because of the shortened flight, but early stages were successfully obtained.) Throughout the flight temperatures were maintained between 19° and 23°C, stabilizing at about 22°C.

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(continued from page 3)

Analysis of the 10 embryos fixed at 41 hours showed them to be morphologically normal compared with ground controls. The five embryos fixed at 85 hours were also well-developed and morphologically normal. The five embryos not fixed were observed to be well-developed, live swimming tadpoles when the experiment package was opened on board the prime recovery ship. Three of these tadpoles were morphologically normal and two were abnormal; however, at this time the abnormality cannot be ascribed to development under a near zero g environment. The five tadpoles died several hours after their recovery, for some as yet undetermined reason. Histological sections of the embryo specimens indicate normal development.

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Aerospace Medical Division  
Brooks AFB, Texas 78235

DR. H. SWAN PRESIDENT  
6700 Lakeridge Road  
Denver, Co. 80227

E. E. SWEENEY P3  
Marquardt Corporation  
16555 Saticoy Street  
Van Nuys, Ca. 91406

DR. K. SWEENEY P3  
Space-General Corporation  
El Monte, Ca.

DR. ANTON SZUTKA P3  
Dept. of Chemistry  
University of Detroit  
4001 West McNichols Road  
Detroit, Michigan 48221

DR. TAKETA P3  
Ames Research Center  
Moffett Field, Ca. 94035

DR. HANS-LUKAS TEUBER P3  
Dept. of Psychology  
Massachusetts Institute of Technology  
Cambridge, Mass. 02139

DR. R. W. TEW P3  
Box 173  
Keller, Ca. 93538

MR. DELBERT D. THIESSEN P3  
Dept. of Psychology  
University of Texas  
Mezes Hall  
Austin, Texas 78712

DR. ELIZABETH THOROGOOD P3  
222 South 40th Street  
Philadelphia, Pa. 19104

ROBERT G. TISCHER, Ph.D., Chairman P3  
Dept. of Microbiology  
Mississippi State University  
P.O. Box 296  
State College, Miss. 39762

DR. CORNELIUS A. TOBIAS P3  
Donner Laboratories  
University of California  
Berkeley, Ca. 94720

DR. ROBERT P. TRAVIS, JR. P3  
The University of Alabama  
Medical Center  
Birmingham, Alabama 35233

DR. H. M. TSUCHIYA P3  
Dept. of Chemical Engineering  
University of Minnesota  
Institute of Technology  
Minneapolis, Minn. 55455

DR. HAROLD C. UREY P3  
School of Science & Engineering  
University of California  
P.O. Box 109  
La Jolla, Ca. 92038

U. S. DEPARTMENT OF THE INTERIOR P3  
Federal Water Pollution  
Control Administration  
Ada, Oklahoma 74820

DR. R. B. VAILE, JR. P3  
Stanford Research Institute  
Menlo Park, Ca. 94025

DR. E. S. VALENSTEIN P3  
Dept. of Psychology & Neurophysiology  
The FELS Research Institute  
Yellow Springs, Ohio 45387

DR. J. R. VALLENTYNE P3  
Dept. of Zoology  
Cornell University  
Ithaca, N. Y. 14850

DR. WOLF VISHNIAC P3  
University of Rochester  
Rochester, N. Y. 14627

R. C. VON BORSTEL P3  
AEC Oak Ridge National Laboratory  
Oak Ridge, Tenn. 37830

DR. JAMES WAGGONER P3  
Dept. of Life Science  
Garrett Corporation  
AiResearch Mfg. Co.  
Los Angeles, Ca. 90045

DR. NIEL WALD P3  
Graduate School of Public Health  
University of Pittsburgh  
Pittsburgh, Pa. 15213

DR. CALVIN H. WARD P3  
AP BES Department  
Rice University  
Houston, Texas

DR. WALLACE H. WALLACE P3  
Associates for Research In Behavior  
3625 Walnut Street  
Philadelphia, Pa. 19104

DR. R. E. WARREN P3  
Massachusetts Institute of Technology  
Cambridge, Mass. 02139

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Space Sciences Laboratory  
University of California  
Berkeley, Ca. 94720

DR. G. R. WEBER P3  
U. S. Industrial Chemical Company  
1275 Section Road  
Cincinnati, Ohio 45237

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2003 East Hennepin Avenue  
Minneapolis, Minn. 55413

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105 East 106th Street (11th Floor)  
New York, N. Y. 10029

DR. H. S. WEISS  
Dept. of Physiology  
Environmental Physiology Laboratory  
Ohio State University  
College of Medicine  
Columbus, Ohio 43210

DR. NORMAN WEISSMAN P3  
Life Sciences Laboratory  
Environmental Biology Division  
NASA Ames Research Center  
Moffett Field, Ca. 94035

DR. S. W. WELLER P3  
Philco Corporation  
Aeronautic Division  
Ford Road  
Newport Beach, Ca. 92663

CLARK W. WESCOE P3  
University of Kansas  
Lawrence, Kansas 66044

J. P. WESLEY P3  
University of Missouri  
Rolla, Missouri 65401

DR. C. R. WESTON P3  
1907 Escharpa Drive  
Eagle Rock, Ca. 90041

DR. G. WHARTON P3  
Dept. of Zoology & Entomology  
Ohio State University  
1735 Neil Avenue  
Columbus, Ohio 43210

PROF. F. L. WHIPPLE P3  
Smithsonian Institute  
Astrophysical Observatory  
Cambridge, Mass. 02138

W. G. WHITEFORD P3  
New Mexico State University  
University Park, N. M. 88070

MR. S. S. WILLIAMSON P3  
Sun City Center  
Sun City, Fl. 33570

DR. C. M. WINGET P3  
Ames Research Center  
Moffett Field, Ca. 94035

ASS'T. PROF. STEPHEN WINOHUR P3  
Dept. of Psychology  
University of Minnesota  
Minneapolis, Minn. 55455

DR. JEROME J. WOLKEN P3  
Biophysical Research Laboratory  
Carnegie Institute of Technology  
Schenley Park  
Pittsburgh, Pa. 15213

PROF. ALBERT ZLATAKIS P3  
Dept. of Chemistry  
University of Houston  
Houston, Texas 77004

DR. JOSEPH ZUBIN, Chief P3  
Psychiatric Research (Biometrics)  
722 West 168 Street  
New York, N. Y. 10032



July 6, 1967

Dear Dr. Kulp:

Would you please add Dr. Wallace to the Bioscience  
Capsule mailing list. His address is:

Dr. Wallace H. Wallace  
Associates for Research in Behavior  
3625 Walnut Street  
Philadelphia, Pennsylvania 19104

Thanks

*Patti*

JUL 17 1967

College of Arts and Sciences  
STATE UNIVERSITY OF NEW YORK AT BUFFALO

Department of Psychology

Townsend Hall  
Administration Road  
Buffalo, New York 14214  
Telephone 831-3208  
Area Code 716

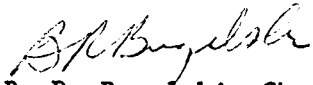
July 13, 1967

Biological Sciences Communication Project  
2000 "P" St., N. W.  
Washington, D. C. 20036

Dear Sirs:

It has come to my attention that your office issues  
a periodical that is titled "Capsule". Would it be possible  
to send me a copy of each issue. The report will be used  
by all members of the Psychology Department.

Sincerely,

  
B. R. Bugelski, Chairman  
Department of Psychology

BRB/jla

JUL 19 1967

H R B - S I N G E R , I N C .

SCIENCE PARK, P.O. BOX 60 • STATE COLLEGE, PA. 16801 • PHONE 814 • 238-4311

July 14, 1967

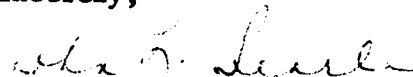
Biological Science Communication Project  
2000 "P" Street, N.W.  
Washington, D.C. 20036

Dear Sirs:

I would like to be placed on the mailing list for the  
"Biological Science Capsule." Also, if you have any other  
publications of similar nature I would appreciate receiving them.

Thanking you for your attention, I remain,

Sincerely,



John L. Searle  
Research Psychologist

JLS/lmw

STATE OF MICHIGAN

AN AGENCY OF THE  
DEPARTMENT OF MENTAL HEALTH  
R. A. KIMMICH, M.D., DIRECTOR



GEORGE ROMNEY  
GOVERNOR

HOMER F. WEIR, M.D.  
MEDICAL SUPERINTENDENT  
GEORGE R. SCHIEVE, M.P.A.  
BUSINESS EXECUTIVE  
GLENVIEW 3-1500

PLYMOUTH STATE HOME & TRAINING SCHOOL  
NORTHVILLE, MICHIGAN

August 10, 1967

The Editor  
Bioscience Capsule  
BSCP, Suite 700  
2000 "P" Street, N.W.  
Washington, D.C. 20036

Dear Sir:

I would appreciate it if you would enroll me  
as a subscriber to Bioscience Capsule.

Very truly yours,

*Maureen A. Bailey*  
Maureen A. Bailey, Ph.D.  
Research Psychologist

MAB/kh



AUG 16 1967



State of New Jersey

BUREAU OF RESEARCH IN NEUROLOGY AND PSYCHIATRY  
C/O NEW JERSEY NEURO-PSYCHIATRIC INSTITUTE  
BOX 1000  
PRINCETON, NEW JERSEY

August 11, 1967

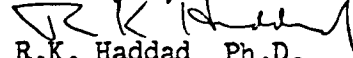
The Editor  
BioScience Capsule  
BSCP, Suite 700  
2000 "P" Street, North-West  
Washington, D.C. 20036

Gentlemen:

Thank you for the April 1967 issue (No.12) of BioScience Capsule.

I would appreciate receiving future issues and such prior issues as may be available.

Thank you,

  
R.K. Haddad, Ph.D.  
Chief of Section,  
Neurophysiology and  
Neuropsychology

RKH/je

August 4, 1967

Mr. Donn K. Jenkins, Manager  
Advanced Programs and Technology  
Bioscience Programs, OSSA  
National Aeronautics and Space  
Administration  
Washington, D. C. 20546

Dear Mr. Jenkins:

In regard to the almost 200 citations and abstracts on space law transmitted to you today, I have reviewed most of the citations and confirm my statement to you concerning their availability to the BSCP from various sources. Should you desire to have full size copies of the documents themselves, we would be very happy to make an attempt to acquire them. Normally, a time period of about two to three weeks is involved and occasionally we are forced to accept microfiche.

The other item you were interested in, the Institute on Space Law, is located at the Oklahoma State University and you can acquire specific information by contacting the Dean of the Law School.

Dr. Shilling has informed me that he is working on your information, storage and retrieval project and will contact you shortly.

If we can be of any additional service to you, please do not hesitate to call on us.

Sincerely,

Leslie A. Kulp, Ph.D.  
Senior Research Scientist

LAK:sr

MARY WASHINGTON COLLEGE  
OF THE UNIVERSITY OF VIRGINIA  
FREDERICKSBURG, VIRGINIA 22401

DEPARTMENT OF BIOLOGY

September 2, 1967

Dr. Leslie Kulp  
Bio Science Communication Project  
George Washington University  
2000 P Street, N.W.  
Washington, D.C.

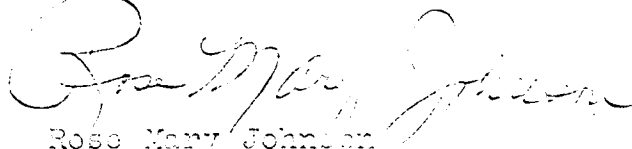
Dear Dr. Kulp:

This summer, I was a participant in the Bio-Space Technology Training Program at Wallop's Island. Dr. Flickinger appointed me "Secretary" and several participants gave me lists of reprints which they desired. Mrs. Virginia Bolton said that I should send them to you so that they could receive the particular publications and that, through your office, they might find further information of publications in their area of interest.

I have, therefore, enclosed such lists with the name and address of the person making the requests. I also gave your name and address to several participants who had not yet formulated their list of requests for reprints.

If some of these requests should be made to other sources, please contact the individual who made the inquiry. The question most participants asked was, "how can I keep up with the literature in my area of interest". Perhaps you could help me with the answer to this question. I would appreciate any information you could give regarding this problem. Thank you.

Sincerely yours,

  
Rose Mary Johnson  
Associate Professor of Biology

September 8, 1967

Dr. Rose Mary Johnson  
Associate Professor of Biology  
Mary Washington College  
Department of Biology  
The University of Virginia  
Fredericksburg, Virginia 22401

Dear Dr. Johnson:

Thank you for your letter of September 2 requesting information concerning space bioscience. After reviewing the list of requested documents enclosed with your letter, it appears that all or nearly all items will be available. However, an interval of several weeks may pass before they can all be collected. This service is provided on a contractual basis between The George Washington University and the Bioscience Programs Division of the National Aeronautics and Space Administration.

In regard to your question on maintaining a current awareness of the state-of-the-art, I would suggest three of the various means that are available. The first is to maintain intimate contact with the professional scientists doing research in your field of interest. Secondly, scan the abstract literature such as provided by "Biological Abstracts" and obtain reprints of the documents most pertinent to your specialty. A third means of keeping yourself scientifically current is to be active in a professional society most directly related to your field.

Your interest in space bioscience is sincerely appreciated and if we can be of additional service to you, please feel free to call on us.

Sincerely,

Leslie A. Kulp, Ph.D.  
Senior Staff Scientist

LAN:sr



H R B - S I N G E R , I N C .

SCIENCE PARK, P.O. BOX 60 • STATE COLLEGE, PA. 16801 • PHONE 814 • 238-4311

July 26, 1967

1967 JUL 27

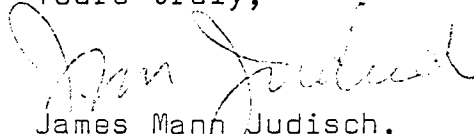
Biological Sciences Communication  
Project  
The George Washington University  
Suite 700, 2000 P Street N.W.  
Washington, D. C. 20036

Dear Sirs:

I would appreciate being placed on the mailing list for your publication, Communique, Volumes I through VI. I understand that there is no charge for this service, however, if I am in error, would you please advise me as to the cost.

Thanking you for your earliest attention to this matter, I remain,

Yours truly,



James Mann Judisch,  
Senior Research Psychologist

JMJ:mpb

August 3, 1967

Dr. James Mann Judisch  
Senior Research Psychologist  
HRB - Singer, Inc.  
Science Park, P.O. Box 60  
State College, Pennsylvania 16801

Dear Dr. Judisch:

Thank you for your interest in our publication series "Scientific Publications of the Bioscience Programs Division". We are happy to send you copies of Volumes I-VI and "NASA Contract Listings of the Behavioral Biology Program"; there is no charge for this service.

The NSCP's "COMMUNIQUEs" are supported by various government agencies for special interest groups and unfortunately cannot be made available on a continuing basis to individuals unless their interests are related to these groups, however exceptions are made for requests from libraries. Therefore, if you would like to continue receiving copies of our publications, it will be necessary to either provide us with a statement of how your activities relate to the space program or these documents will have to be obtained through your library.

Enclosed is a list of the NSCP's "COMMUNIQUEs AND SPECIAL REPORTS" to date, although some are out of print, many of them are still available and if there are some in which you are especially interested we will try to obtain copies for you.

Sincerely yours,

Leslie A. Kulp, Ph.D.  
Senior Research Scientist

LAK:er

Enclosures

**GENERAL DYNAMICS**

**Convair Division**

Kearny Mesa Plant, P.O. Box 1128, San Diego, California 92112 · 714-277-8900  
Lindbergh Field Plant, P.O. Box 1950, San Diego, California 92112 · 714-296-6611

Procurement, P.O. Box 172 · Accounting, P.O. Box 1708

JUL 3 RECD

1 copy  
WY L

In Reply Refer To:  
592-0-484:BDN/js  
29 June 1967

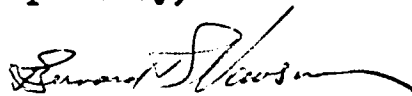
This is the  
material on  
which we are  
to select references.  
ACD

Charles W. Shilling, M.D.  
Biological Sciences Communication Project  
George Washington University  
Suite 700  
200 P. Street, N.W.  
Washington, D.C.

Dear Doctor Shilling:

In accordance with our telephone conversation of 29 June pertaining to the retrieval of material for Monograph #19 of the Foundations of Space Biology and Medicine, I am enclosing an outline of Chapter 1. After talking with you, I re-examined the words used for topic items and feel that they may not be satisfactory as key words for the computer program. There is, therefore, a second enclosure with a subject list that I hope might better serve the purpose. In each case, I have combined the subject item with limiting words. If this is too comprehensive, please notify me and I will try to shorten the list.

Respectfully,



Bernard D. Newsom, Ph.D.  
Senior Staff Scientist  
Mail Zone 592-0

Enclosures: 2

MONOGRAPH #19

PROTECTION OF MAN AGAINST ADVERSE FLIGHT FACTORS

CHAPTER 1. PROTECTION AGAINST RADIATION (Newsom)

A. Ionizing Radiation

1. The Radiation Environment

Reference Monograph #1, "Physical Characteristics of Interplanetary Space," by J. A. Van Allen.

Summarize including Argus effects, sources of radiation aboard spacecraft, solar flare prediction.

2. Biological Effects

Reference Monograph #7, "Effects on Organism of Radiant Energy from Cosmic Space," by C. A. Tobias.

Summarize:

- a. General Syndrome (electromagnetic, particulate, anticipated space radiation, prolonged and fractionated exposure).
- b. Recovery (concept, electromagnetic/particulate).
- c. Late Effects
- d. Partial Body Irradiation
- e. Primary Cosmic Damage
- f. Low Level Irradiation and Accumulated Dose Effect
- g. Combined Effects (effect of stress on radiation syndrome, performance degradation, mission consequences).
- h. Instrumentation
- i. Radiation Modeling of Man

3. Protection from Radiation Hazards in Space

Reference Monograph #15, "Selection of Astronauts," by J. Bollerud.

a. Mission Planning and Astronaut Selection

(1) Allowable Dose

- (a) Space Crew vs. Population
- (b) Dose Accumulation
- (c) Risk Proportioning

(2) Importance of Crew Age

- (a) Experience
- (b) Dose Accumulated
- (c) Time for Late Effects
- (d) Life Shortening

b. Status of Radioprotective Pharmaceuticals and Therapy

- (1) General Theory of Protective Agents (hematopoetic, intestinal, late effects).
- (2) Recovery Implementation
- (3) Agents (promising materials, toxicity, single vs. multiple agents, drugs and partial body shielding).
- (4) Marrow Bank
- (5) Antibiotic Support

c. Physical Methods of Radiation Protection

(1) Current Physical Models

- (a) The Ambient Radiation Environment
- (b) The Spacecraft
- (c) Model Interactions

(2) Materials Selection and Shielding Effectiveness

(3) Operational Factors

(4) Man/System Integration

(5) Lunar Shelter Problem

(6) Storm Cellar Problem

B. Non-Ionizing Radiation

1. Reference Monograph #17 and #18.

Summarize including direct solar radiation, earthshine, earth albedo, space vehicle thermal radiation and albedo, lunar and planetary visual environment.

2. Biological and Behavioral Effects

a. Flash Blindness and Retinal Burns

b. Relation of Visual Environment to Performance

(1) Vision in Space (lighting, shadow shielding)

(2) Vision on Lunar and Planetary Surfaces

(3) Circadian Rhythms

3. Protection Against Non-Ionizing Radiation

a. Helmet Facepiece Design

b. Vehicle Portholes

CHAPTER 2. CURRENT MEDICAL SUPPORT OF SPACECRAFT CREWS  
BEFORE AND AFTER LAUNCH (Busby)

A. Medical Procedures Before Launch

Reference Monograph #15, "Selection and Training of Astronauts."

1. Selection and Training (including physical fitness and vestibular tolerance).

2. Quarantine

3. Familiarization (excretory equipment, drug usage, medical contingencies).

#### 4. Checkout and Countdown Procedures

#### B. Medical Procedures After Launch

1. Training and Dispersion of Medical Monitors (including biomedical monitoring parameters, communications, etc.)
2. In-Flight Medical Treatment Capability (medical kit, zero G and Confinement Countermeasures)
3. Operational Medical Contingencies (including launch abort and provisions for emergency care)

### CHAPTER 3. CURRENT MEDICAL SUPPORT OF SPACECRAFT CREWS DURING AND AFTER LANDING ON EARTH AND OTHER CELESTIAL BODIES (Lawton)

#### A. Landing Stresses

Reference Monograph #10, "Effects on the Organism of Dynamic Flight Factors," by A. Graybiel.

1. Tolerance Limits (deceleration, heat, impact, vibration, noise)
2. Recommended Levels

#### B. Landing on Earth

1. Astronaut Survival Training (water, land)
2. Medical Support During Recovery

#### C. Landing on Other Celestial Bodies

1. Medical Support and Contingencies for Apollo

### CHAPTER 4. FUTURE MEDICAL SUPPORT OF SPACECRAFT AND SPACE STATION CREWS

#### A. A Prospective Look at Possible Medical Problems in Space

1. Life Support System and Crew Equipment Failure Modes and Effects Analysis (Waggoner)

Reference Monograph #17 (LSS) and #18 (Crew Equipment)

- a. Method
- b. Examples Involving Current Equipment

2. Possible Medical Problems from (Busby):

- a. Spacecraft Hardware Failures
- b. Space Operations
- c. Naturally-Occurring Diseases
- d. "Space-Oriented" Treatment

B. Future Medical Capabilities in Space (Busby)

- 1. Future System Constraints (medical astronaut, corpsman astronaut, crew size, space station and spacecraft size and facilities, mission duration).
- 2. Future in Space and Ground Medical Support, Diagnostic and Therapeutic Facilities.





July 10, 1967

Dr. Bernard D. Newsom  
Senior Staff Scientist  
Kearny Mesa Plant  
General Dynamics, Convair Division  
P.O. Box 1128  
San Diego, California 92112

Dear Dr. Newsom:

This is to acknowledge receipt of your letter of June 29 requesting bibliographic data for the preparation of Monograph #19 of The Foundations of Space Biology and Medicine. Your particular monograph encompasses a broad scope of space biology parameters and it may be sometime before we can provide you with your material. We have, however, initiated efforts on this matter and the material is being collated and prepared for manuscript. In the meantime, we are sending you some bibliographic references on sources of information pertinent to your interest.

Sincerely,

Leslie A. Kulp, Ph.D.  
Senior Research Scientist

LAK:sr

Enclosure

## ENCLOSURES

1. An Experiment to Measure Human Chromosome Aberration rates from Irradiation in the Absence of Gravity.
2. Vehicle Shielding in Space.
3. Radiation Measurements on the Ninth Mercury-Atlas Mission (MA-9).
4. Radiation Dosimetry Aboard the Spacecraft of the Eighth Mercury-Atlas Mission (MA-8).
5. Ionizing Radiation hazards in Space.
6. Soviet Microastronautics and Biotechnology - 1964.
7. Fundamental Investigation of Losses of Skeletal Mineral in Young Adult Human Males and Collaterally in Young Adult Male Pigtail Monkeys (*Macacus nemestrina*) through Immobilization for varying Periods of Time, Coupled with a Study of Methods of Preventing or Reducing Mineral Loss.
8. Comparative Characteristics of Radiation Sickness in Various Mammal Species, Including Primates.
9. Synergistic Effect of Zero-G and Radiation on White Blood Cells.
10. The Main Results of the USSR Biological Researches in Conditions of the Space Flights and the Perspectives of the Space Physiology and Medicine.
11. Problems of Space Biology.
12. Radiation Effects upon Experimental Animals, Man, and Plants: An Annotated Bibliography, Vol. I.
13. Radiation Effects upon Experimental Animals, Man, and Plants: An Annotated Bibliography, Vol. II.
14. The Effects of Radiation and Radioisotopes on the Life Processes - An Annotated Bibliography, Book 1.
15. The Effects of Radiation and Radioisotopes on the Life Processes - An Annotated Bibliography, Book 2.
16. The Effects of Radiation and Radioisotopes on the Life Processes - An Annotated Bibliography, Index.
17. Biological Effects of Ionizing Radiation, An Annotated Bibliography Index.
18. Biological Effects of Ionizing Radiation, An Annotated Bibliography Abstracts.

# GENERAL DYNAMICS

## Convair Division

Kearny Mesa Plant, P.O. Box 1128, San Diego, California 92112 · 714-277-8900    Procurement, P.O. Box 172 · Accounting, P.O. Box 1708  
Lindbergh Field Plant, P.O. Box 1950, San Diego, California 92112 · 714-296-6611

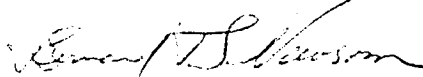
In Reply Refer To:  
592-0-497:BDN/js  
16 August 1967

Leslie A. Kulp, M.D.  
Senior Research Scientist  
Biological Sciences Communication Project  
Suite 700  
200 P Street, N.W.  
Washington, D.C. 20036

Dear Doctor Kulp:

Thank you for your attention to my request for bibliographic material. I realize the list I made for Monograph #19 of the Foundation of Space Biology was very comprehensive and should it be unreasonable, please do not hesitate to request a reduction or to modify it yourself. I have not had experience with retrieval systems such as yours and may not have approached the topic correctly. The material you forwarded to me has been of considerable help in establishing a general background and it is much appreciated.

I am respectfully,



Bernard D. Newsom, Ph.D.  
Senior Staff Scientist  
Mail Zone 592-00

September 12, 1967

Dr. Bernard D. Newsom  
Senior Staff Scientist  
Mail Zone 592-00  
General Dynamics, Convair Division  
Kearny Mesa Plant, P.O. Box 1128  
San Diego, California 92112

Dear Dr. Newsom:

Enclosed is "Radiobiology - A Selected Bibliography", a BSCP report undertaken in partial support of the efforts made by the compilers of the Monograph Series entitled "Foundations of Space Biology and Medicine".

As indicated in the preface, this task was primarily accomplished to announce reference material available from the BSCP for two of the chapters including the one for which you will be compiler, "Protection of Man Against Adverse Flight Factors". Although a few of the references may no longer be available through the abstracting services, I am certain that should you have need for any of these publications, provided your list is not too extensive, we could obtain them for you.

If we can assist you in your effort to write this manuscript, please do not hesitate to call upon us.

Sincerely,

Leslie A. Kulp, Ph.D.  
Senior Staff Scientist

LAK:sr

Enclosure

# **GENERAL DYNAMICS**

## **Convair Division**

Kearny Mesa Plant, P. O. Box 1128, San Diego, California 92112 · 714-277-8900  
Lindbergh Field Plant, P. O. Box 1950, San Diego, California 92112 · 714-296-6611

Procurement, P. O. Box 172 · Accounting, P. O. Box 1708

In Reply Refer to:  
592-O-506/BDN:bk  
13 September 1967

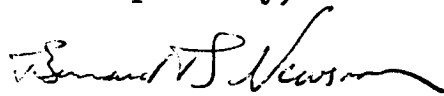
Dr. L. A. Kulp, Ph. D.  
Senior Staff Scientist  
The George Washington University  
Biological Sciences Communication Project  
Suite 700, 2000 P Street,  
N. W./Washington, D. C.

Dear Dr. Kulp:

I received the copy of "Radiobiology - A Selected Bibliography" today and I am sure it will be of considerable help in the task that is about to be commenced. We shall attempt to obtain as many of the references as possible locally and through our library retrieval system. Should we find some that are not available to obtain, I will write you for additional help. I suspect the Lovelace Foundation Library will be of great help to me in this regard.

Many thanks for your support.

I am respectfully,



Bernard D. Newsom, Ph. D.  
Senior Staff Scientist

DEPARTMENT OF MENTAL HYGIENE

THE LANGLEY PORTER NEUROPSYCHIATRIC INSTITUTE

1 PARNASSUS AVENUE  
SAN FRANCISCO, CALIFORNIA 94122



September 5, 1967

Leslie A. Kulp, Ph.D.  
Senior Research Scientist  
The George Washington University  
Biological Sciences Communication  
Project of the Airlie Center  
Suite 700  
2000 P Street, N.W.  
Washington, D.C. 20036

Dear Dr. Kulp:

Thank you for the copy of Volume I, "Behavioral Biology"  
which I requested from you, it looks like it will be  
very helpful.

Sincerely yours,

A handwritten signature in cursive script that reads 'George C. Stone'.

George C. Stone, Ph.D.  
Research Psychologist

GCS:mk

September 13, 1967

Dr. Cornelius A. Tobias  
Donner Laboratory and Donner  
Pavilion  
University of California  
Berkeley, California 94720

Dear Dr. Tobias:

Enclosed is "Radiobiology - A Selected Bibliography", a BSCP report undertaken in partial support of the efforts made by the compilers of the Monograph Series entitled "Foundations of Space Biology and Medicine".

As indicated in the preface, this task was primarily accomplished to announce reference material available from the BSCP for two of the chapters including the one for which you will be compiler, "Effect on the Organism of Radiant Energy from Cosmic Space". Although a few of the references may no longer be available through the abstracting services, I am certain that should you have need for any of these publications, provided your list was not too extensive, we could obtain them for you.

If we can assist you in your effort to write this manuscript, please do not hesitate to call upon us.

Sincerely,

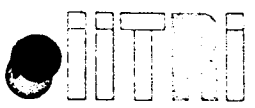
Leslie A. Kulp, Ph.D.  
Senior Staff Scientist

LAK:sr

Enclosure



7/21



IIT Research Institute  
10 West 35 Street, Chicago, Illinois 60616  
312/225-9630

July 18, 1967

Miss Frances Hong  
Biological Sciences Communication Project  
The George Washington University  
Suite 7000  
2000 P Street, N. W.  
Washington, D. C. 20036

Dear Miss Hong:

I would appreciate it very much if you could forward a copy of your recent project communique, Scientific Publications of the Bioscience Programs Division, Volume III, Exobiology, performed under NASA contract NSR 09-010-027. Also, if possible, I would appreciate a copy of Volume IV on Physical Biology.

Thank you for your assistance.

Very truly yours,

*Ronald Wojcik*

Ronald Wojcik  
Astro Sciences Center

RW:la

July 25, 1967

Mr. Ronald Wojcik  
IIT Research Institute  
10 West 35th Street  
Chicago, Illinois 60616

Dear Mr. Wojcik:

Enclosed are the two volumes of "Scientific Publications of the Bioscience Programs Division, National Aeronautics and Space Administration", Volume III - Exobiology and Volume IV - Physical Biology, which you requested on July 18.

If we can be of any further assistance to you, please do not hesitate to call on us.

Sincerely,

(Miss) Frances Hong  
Research Associate

/sr

Enclosures

### III. PERSONNEL

The following individuals have spent a considerable amount of time on the forestated activities under this contract during this quarterly period.

#### A. BSCP Professional Staff

1. Dr. C. W. Shilling, M.D., Director
2. Mr. Irvin Mohler, M.S., Assistant to the Director
3. Dr. L. A. Kulp, Ph.D., Senior Staff Scientist - Bioscience Communications
4. Mr. D. E. Wright, M.P.H., Senior Staff Scientist - Planetary Quarantine
5. Mrs. Mary Shipp Watson, M.S., Senior Scientist
6. Mr. Bruce Berman, M.A., Technical Science Writer
7. Mr. Morton Werber, M.S., Technical Science Writer
8. Miss Frances Hong, B.S., Research Associate
9. Miss Benita Tall, B.A., Science Writer
10. Miss Helen Selvig, A.B., Technical Science Librarian

#### B. BSCP Non-Professional Staff

11. Mrs. Marilyn Whitehead, Administrative Associate
12. Miss Sheila Rollins, Administrative Assistant
13. Mrs. Jean Pulliam, Technical Science Librarian (new)
14. Miss Jacqueline Gainesford, Secretary
15. Mrs. Barbara Caldwell, Secretary
16. Miss Lydia Homann, Secretary
17. Mrs. Mary Hourican, Clerk Typist
18. Mrs. Michele Griggs, Secretary
19. Miss Marlene Mostowy, Secretary
20. Miss Carolyn Burt, Secretary

21. Miss Patricia Fox, Secretary
22. Mrs. Shirley Spense, Secretary
23. Mr. Jesse Gibbs, Technician

C. BSCP Part-Time Staff

24. Mr. Bryan Caldwell, B.S., Clerk
25. Miss Ann Walker, B.S., Clerk
26. Mr. Robert Griggs, Clerk
27. Mr. Bert Kenyon, Clerk
28. Miss Janet Whitehead, Clerk

D. Non-BSCP Professional Support (consultants, special services, etc.)

29. Mr. Carl Schott, Senior Engineer, Tri-Delta Corporation
30. Dr. Mary Danielli, State University of New York at Buffalo
31. Dr. Norman Scotch, Associate Professor in Social Anthropology, The Johns Hopkins University